

Bus Rapid Transit Town Center Integration Study

January to September 2015

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Prepared for

**City of Rockville, Department of Community Planning and Development
Services**

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Summary and Key Findings

The City of Rockville commissioned this Integration Study (Study) to identify possible design solutions for integrating Bus Rapid Transit (BRT) in the Rockville Town Center area. The City has been engaged in the BRT corridor planning efforts currently being conducted by Montgomery County and the Maryland Department of Transportation for MD 355 and Veirs Mill Road.

In an effort to more carefully identify BRT options in this critical part of Rockville, the City initiated this study to understand how the BRT routes could be accommodated while enhancing the Town Center area where so much investment and redevelopment have already occurred under the guidance of Rockville's 2001 Town Center Master Plan. As the county seat and with a downtown that has been a longstanding center of economic and government activity, the City has stressed a strong desire to ensure that BRT improvements work within and for the Rockville community while also serving the needs of the overall transportation network.

To achieve the Study objectives, a Study team of City staff and consultants:

1. Explored BRT alternatives that focus on features of interest to the City,
2. Integrated into the BRT alternative designs Town Center Master Plan guidance,
3. Worked collaboratively with Montgomery County, the State Highway Administration (SHA), the Maryland Transit Administration (MTA) and the Washington Metropolitan Area Transit Authority (WMATA).

The City intends to use this Study to:

1. Understand how the BRT Plan could affect Town Center
2. Identify issues (potential problems) and potential opportunities (options).
3. Provide a basis for discussions with the public and with City officials regarding BRT, and for input to Montgomery County and the State regarding the planning and eventual implementation of the BRT Plan.

The Study area was the MD 355 and Veirs Mill Road corridors from just north of Beall Avenue to First Street. This area has a mix of land uses and conditions that create three distinct areas with differing characteristics: 1) a central area immediately surrounding the Rockville Metro Station; 2) a northern area between Beall and Washington Avenues; and 3) a southern area generally surrounding the Veterans Memorial Park. Existing conditions together with the introduction of BRT present issues and challenges for Town Center integration as well as a more complete streets and transit-oriented development approach to the study area.

The Study team identified six principles for evaluating BRT designs:

1. BRT supports Town Center design and development goals
2. BRT expands travel options for Rockville residents, workers, shoppers and visitors

3. BRT integrates with the street network, and motor vehicle levels of service are at least maintained
4. BRT integrates with the Rockville Metro station and other transit service
5. BRT station is convenient and safe for users
6. BRT integrates with bicycle routes and users.

The selection of options for detailed assessment in this Study began with a menu of 12 configuration alternatives. Through a series of interagency meetings, the consensus was to advance three concepts for further study (recognizing in part that Montgomery County and the State would be evaluating other alternatives).

Concept 2. Mixed-traffic with near side¹ pull-outs. BRT service would operate in mixed-traffic curb lanes on either side of MD 355 through the study area. Where possible, curbside enhancements including queue jumps (allowing buses to proceed ahead of other traffic stopped at intersections) with signal priority, and pull-out platform locations would be included.

Concept 4. Dedicated lanes in median. BRT service would run in a median guideway, which would be primarily dual lane but would also have limited sections of bi-directional single lane where the need to preserve mixed traffic left-turning lanes is critical.

Concept 6. Dedicated lanes in median with through traffic in tunnel. Through traffic on MD 355 would be diverted to a 0.70 mile long four-lane tunnel from south of Dodge Street and north of Beall Avenue (see Figure 20). Existing at-grade travel lanes would be reconfigured to provide two through lanes in either direction, turn lanes and a two-lane buffered BRT guideway in the median of MD 355.

The three concepts offer varying levels of BRT and transportation improvements, although in some measure they provide similar types of urban design improvement opportunities. However, they vary in terms of scale and ability to create dramatic and positive change on the MD 355-Veirs Mill Road corridors and integrate with Rockville's Town Center.

Of the three concepts, Concept 6 would offer the greatest opportunities for transportation and urban design improvement in the central portion of the MD 355 – Rockville Pike corridor because it would remove two at-grade travel lanes of travel and replace them underground with four through traffic lanes. This positive transportation trade-off would also allow the existing right-of-way to be better utilized for pedestrian and BRT transit patron use at the surface, enhancing the corridor for multi-modal use. It requires relatively modest widening in some areas of the central area, while also optimizing the number of both public realm spaces for enhancement and public/private properties for economic redevelopment along the corridor.

Of the three concepts, Concept 6 would have the highest cost, but would have the greatest integration potential. Concept 2 offers a viable cost effective, short term solution, if necessary.

¹ A stop located along the curb in advance of an intersection.

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Cover photos:

Vision sketch for Rockville BRT (see Sections 5.2 and 5.3)

Station on the Cleveland Ohio's RTA's HealthLine

1. Study Objective and Background

The City of Rockville commissioned this study to identify possible design solutions for integrating Bus Rapid Transit (BRT) in the Rockville Town Center area. The City has been engaged in the BRT corridor planning efforts currently being conducted by Montgomery County and the Maryland Department of Transportation for MD 355 and Veirs Mill Road.

In an effort to more carefully identify BRT options in this critical part of Rockville, the City initiated this study to understand how the BRT routes could be accommodated while enhancing the Town Center area where so much investment and redevelopment have already occurred (and continue to occur) under the guidance of Rockville's 2001 Town Center Master Plan. As the county seat and with a downtown that has been a longstanding center of economic and government activity, the City has stressed a strong desire to ensure that BRT improvements work within and for the Rockville community while also serving the needs of the overall transportation network.

1.1 Objective

The objective of the Bus Rapid Transit Town Center Integration Study is to:

Generate BRT design concepts that will enhance Town Center while accommodating BRT service into the area, and integrate with the Metro station and current transit service.

To achieve this objective the City wanted to:

1. Explore BRT alternatives that focus on features of interest to the City.
2. Integrate into the BRT alternative designs Town Center Master Plan guidance (in all its urban design and transportation aspects).
3. Work collaboratively with Montgomery County and the State Highway Administration (SHA), Maryland Transit Administration (MTA) as well as the Washington Metropolitan Area Transit Authority (WMATA), sharing our respective interests and shaping subsequent steps in each other's processes.

Figure 1 shows the Study Area, the MD 355 and Veirs Mill Road corridors from just north of Beall Avenue to First Street.

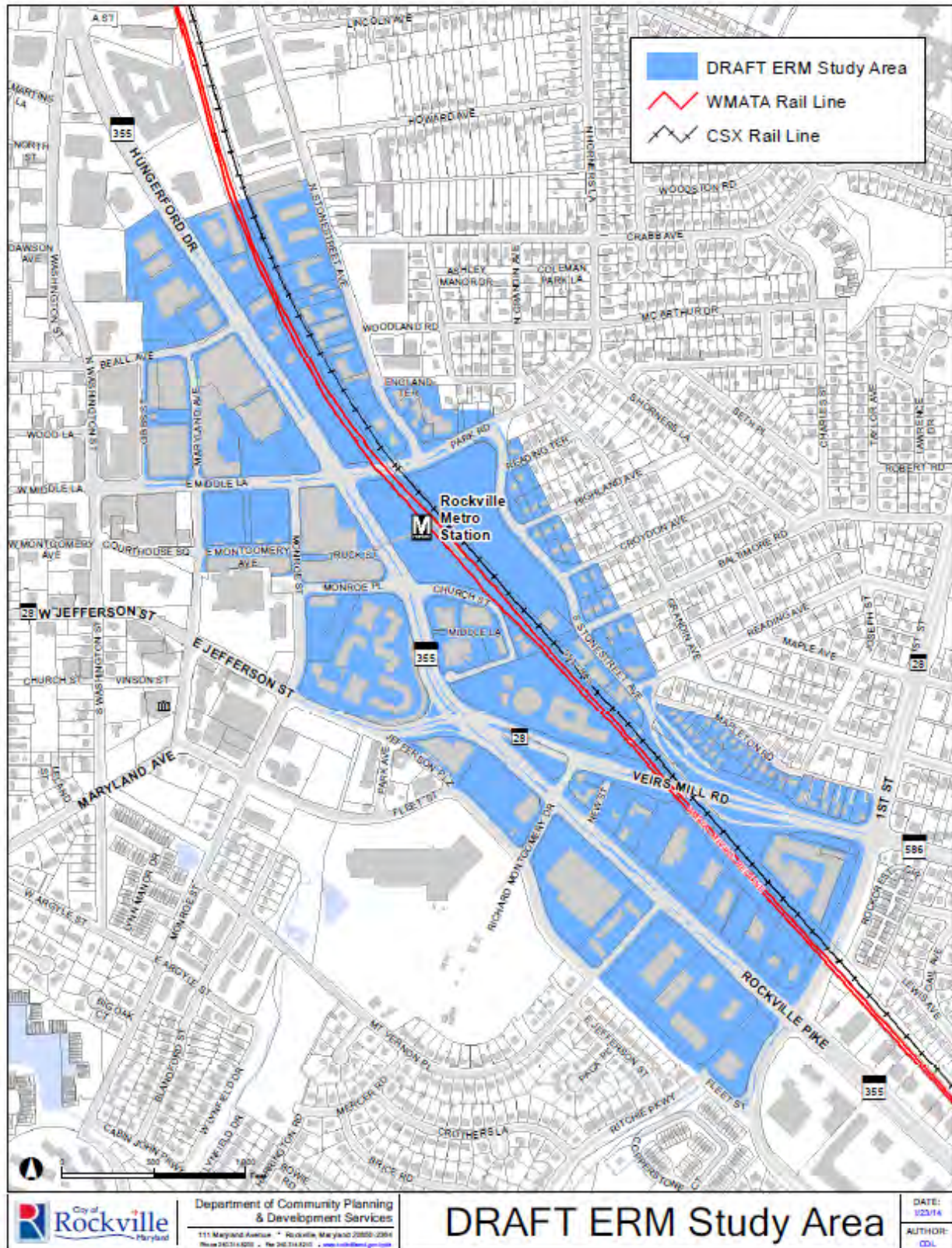
Opportunities

Bus Rapid Transit brings several opportunities to the City. The County BRT Plan does not call for a specific cross section or BRT treatment within cities, but instead allows the municipalities to provide such direction given their separate land use authority.

BRT brings the potential for major new investment – potentially in the hundreds of millions of dollars by federal, state and local governments, further proof of the City’s vibrancy and importance in the region. In addition it brings opportunity to:

- Address evolving traffic and mobility patterns – car, Metro, bus, pedestrian, bicycle, Amtrak, and MARC;
- Integrate the next generation of transit into Town Center;
- Integrate with the heavily used but aging Rockville Metro Station;
- Build on Town Center development progress; and
- Revisit Town Center Master Plan ideas.

Figure 1 Study Area



1.2 Use of the Integration Study

The City intends to use this Study to:

1. Understand how the BRT Plan could affect Town Center with respect to: urban form and land use relationships; motor vehicle circulation and access; and pedestrian and bicycle mobility and access.
2. Identify issues (potential problems) and potential opportunities (options) associated with these considerations.
3. Provide a basis for discussions with the public and with City officials regarding BRT, and for input to Montgomery County and the State regarding the planning and eventual implementation of the BRT Plan. The BRT Plan requires confirmation of stations and BRT treatment (e.g., lanes) by the City of Rockville, and this study attempts to identify alternatives that support the City's Town Center goals while accommodating the BRT network.

The Integration Study is intended to be a high level, visionary assessment showing possible options and solutions for the City to explore and the trade-offs among the different options. To ensure that the options were realistic, the plans, drawings, and sketches in the study are detailed. Notwithstanding the depiction of precise dimensions on these figures, in planning the BRT system, much more planning, design and input will be critical and will occur for years to come.

Both a previous 2014 Issues and Potentials Study and this Integration Study show that trade-offs will need to be made between motor vehicle, transit, and pedestrian and bicycle needs and wants. Given a limited amount of roadway space and additional right-of-way that would be available, it may not be possible to accommodate all of the City's desired features through this corridor. The Integration Study was an attempt to begin to identify possibilities that can be explored as BRT planning studies advance, and to help the City understand how BRT may interact with the Town Center area. The Study was not an attempt to generate ultimate design solutions at this stage of the process.

1.3 Background

Transit Corridors Functional Master Plan

Montgomery County adopted a Countywide Transit Corridors Functional Master Plan (the BRT Plan²) in November 2013 that recommends a 102-mile bus rapid transit (BRT) network (including the Corridor Cities Transitway) in 10 corridors in the central and southern parts of the County (Figure 2). Three of the corridors (MD 355 South, MD 355 North, and Veirs Mill Road) would run through the City of Rockville and converge in the City's Town Center where the City has been undertaking and implementing the current generation of redevelopment planning since the 1990s, especially with the completion of the Rockville Town Square project in 2007.

² The Plan does not address BRT exclusively, but for simplicity we refer to it as the BRT Plan.

The term “Bus Rapid Transit” (BRT) refers to buses or specialized vehicles on roadways typically within dedicated lanes that quickly and efficiently transport passengers to their destinations. The intent is to provide frequent, fast, and reliable high capacity transit service at a lower cost compared to other modes of transportation such as light rail or Metrorail (heavy rail).

BRT implementation will require a significant capital investment from multiple agencies and sources that has the potential to enhance Town Center by increasing and diversifying access and transportation options. However, the City is concerned about the potential impacts brought on by BRT investment if the corridors are not designed and implemented in a manner that improves the experience of people who use the Town Center area. Also, while some of the BRT routes identified so far could potentially benefit Rockville, City officials have also expressed concern in making sure the city is not just a pass-through jurisdiction, but rather that BRT will truly provide benefits to local residents and businesses.

BRT Service Plans

The BRT service plans are expected to evolve as planning and engineering by Montgomery County and the State continues. The City used the Countywide Transit Corridors Functional Master Plan and other recent planning documents for the planning assumptions it needed for this Integration Study.

The BRT routes along MD 355 (Rockville Pike) and MD 586 (Veirs Mill Road) are expected to operate with frequent (less than 10 minute) headways along both roadways. The vehicles will be branded to distinguish them from local bus service, have multi-door and low floor boarding, and will require off-board fare payments. The 355 BRT corridor is expected to run from Clarksburg to Bethesda, and it may be split into a north segment and south segment with Rockville as southern and northern limit, respectively, or it may operate as a “single seat” ride along the entire length. Those operational details have not yet been determined. The 586 BRT corridor will run from the Wheaton Metro Station to Rockville. There is only one stop proposed in the Town Center – at the Rockville Metro Station. The Integration Study assumed that the southern 355 and 586 services would both run through the Rockville Metro Station and provide service to the Montgomery County College campus for at least some of the service along this corridor, given the high ridership potential of the College.



Figure 2 Recommended BRT Corridors in Montgomery County

Issues and Potentials Study

A 2014 City of Rockville Issues and Potentials Study³ identified a number of challenges and conditions in the study area and they remain relevant for this Town Center Integration Study. They include, but are not limited to, the following:

- The Rockville Metro station is a significant hub of transit and multi-modal activity, with service by Metrorail, Metro bus, Ride-On bus, Amtrak, and MARC commuter trains.
- Although pedestrian activity is very high, safe and effective access between the Metro station and Town Center is lacking.
- The intersection adjacent to the Rockville Metro station (MD 355 at Park Road/Middle Lane) carries a high volume of traffic as well, and also provides major access into the East Rockville neighborhood.
- The MD 355 corridor is already built out to six lanes, with little obvious physical room to expand to accommodate another dedicated lane for BRT given a number of existing structures close to the roadway, the presence of historic sites (including St. Mary's Church and cemetery) and the city's Veteran's Park.
- The corridors under consideration (MD 355 and MD 28/586) carry a large volume of vehicular traffic today which is also expected well into the future. The geometric

³ Phase 1 Bus Rapid Transit Issues and Potentials in Rockville Town Center, Preliminary Review, March to June, 2014, Final Report July 10, 2014

configuration where these routes come together at the “mixing bowl” is challenging for traffic management and flow, and aesthetically is not very inviting into the Town Center area.

- A series of four rail lines runs generally parallel to the MD 355 corridor – two operated by WMATA, and two by CSX – which creates separation between neighborhoods and also presents limitations in terms of urban design solutions that may be implemented in the area.
- As the county or state attempts to implement BRT lanes through Town Center, these challenges could be exacerbated if improvements are not designed and implemented in a manner consistent with the pedestrian environment envisioned by the city. BRT will also likely need additional right of way (ROW) as existing ROW is limited. Acquiring ROW can be costly and wide roadways are not desirable in the parts of Town Center where a goal is to create a walkable environment.

Town Center Master Plan

The City’s adopted Town Center Master Plan (2001) identifies a number of possible transportation enhancements and development measures that are particularly relevant when considering the implementation of BRT. With BRT planning underway, now is an opportune time to consider whether these potential improvements are still relevant. They include (among others):

- A pedestrian promenade over MD 355 that would more effectively connect the Metro station (and East Rockville) to Town Center, and provide a safe, direct pedestrian link.
- The possibility of undergrounding a portion of MD 355 as a long term solution to congestion and improving connectivity between the Metro station and Town Center.
- Opportunities for redevelopment of the existing WMATA site and other key properties such as 255 Rockville Pike.

Other Studies

There are a large number of documents and prior studies relevant to the Integration Study. Even the older ones are important to review because they show how ideas for the Town Center have evolved. Some ideas from earlier plans that may not have been adopted may merit reconsideration in light of the BRT Plan and other changes. Attachment A is a “Document Chronology” that lists and summarizes these documents.

Among these documents two were reviewed particularly carefully by the Integration Study team:

- State Highway Administration (SHA) Rockville Town Center Study, 1998 to 2000.
- WMATA Rockville Station Access Study, 2005

2. Existing conditions

2.1 Land use and urban design setting

The Rockville Town Center portion of the MD 355/Rockville Pike BRT corridor is comprised of a mix of land uses and urban conditions that create three distinct areas with differing characteristics: 1) a central area immediately surrounding the Rockville Metro Station; 2) a northern area between Beall and Washington Avenues; and 3) a southern area generally surrounding the Veterans Memorial Park. The central area, between Beall Avenue and Monroe Place, is largely comprised of a mix of WMATA transportation and transit oriented uses, Montgomery County offices, private-sector corporate offices, commercial uses and public/private parking garages being served from MD 355. This portion of the corridor conveys the most urban character due in large part to the Rockville Town Center infill development on the west side of the corridor. The Choice Hotels headquarters building at MD 355 and Middle Lane is a good example of this design treatment. The Rockville Metro Station and bus services generate a large amount of pedestrian, bicycle and transit activity between the Town Center and the Metro Station, helping to make the area feel more transit-oriented and less auto-dominant, although Rockville Pike is 6-7 lanes wide in this area.

The north end of the corridor, between Beall Avenue and Washington Street, is much more suburban in character, but is also active with its Rockville Volunteer Fire Station, well-occupied office buildings, residential condominiums and many commercial uses serving the area including pharmacies, banks and eateries to name a few. Most of these uses are serviced through surface parking lots and service lanes that parallel the MD 355 corridor, making the distance between uses on the corridor quite wide and heavily auto-oriented.

Like the north end, the south end of the MD 355 corridor, between Monroe Place and Mount Vernon Place, is also comprised of a mix of uses: faith-based institutions, office buildings, assisted living, residential condominiums and auto-oriented commercial uses. What differentiates this area from the area to the north is the juxtaposition and intertwined nature of MD 28/Veirs Mill Road and Dodge Street with MD 355, which defines the Veterans Memorial Park and south gateway to the Rockville Town Center.

With the exception of the more pedestrian-oriented west side blocks between East Middle Lane and Beall Avenue, the largely vehicle-oriented urban setting along the MD 355 and MD 28/Veirs Mill Road corridors is largely the result of an emphasis on moving vehicles to avoid traffic congestion and allowing for highway-oriented development through Rockville prior to the 2001 Town Center Master Plan and subsequent redevelopment of the former Rockville mall site. As such, until the early to mid-2000s, these State-owned corridors were seen as thoroughfares first and foremost rather than as complete streets that could function well for a variety of user groups. As a result there were few design amenity adjustments to the public realm or to private sites that line the corridors. Please see the “Rockville Town Center BRT Integration Existing Conditions and Potential Approaches” powerpoint slides in Attachment B for photographs of existing conditions.

Issues and challenges:

The conditions described above together with the introduction of BRT present issues and challenges for Town Center integration as well as a more complete streets and transit-oriented development approach to the MD 355/MD 28 corridors.

1. **MD 355 versus Town Center.** With a few limited exceptions, such as the Choice Hotels headquarters building, MD 355 does not feel part of Town Center. The 2001 Town Center Master Plan does illustrate a vision and plan for redevelopment along the corridor that includes MD 355 within the urban grid. However, since 2001, only the west side of MD 355 between East Middle Street and Beall Avenue has been redeveloped with architectural frontage/facades and associated streetscape enhancements that begin to make the corridor feel more like an urban boulevard, but still on the edge of the more vibrant and walkable Town Center. An extension of the Town Center's character along the corridor is planned, with additional redevelopment anticipated around East Dawson Street, but additional redevelopment of three to four key sites coupled with a continuous, high quality urban boulevard streetscape is needed to truly make the MD 355 corridor equally important to the Town Center as Maryland Avenue and Montgomery Avenue are today. Both Rockville Pike and the Rockville Metro Station area must continue to transition from barrier to unifying boulevard between East and West Rockville for the corridor to reach its full potential for the Town Center.
2. **255 Rockville Pike site.** This site represents the last remaining piece of the original Rockville Mall site and is currently being used for County office space. Given its previous use, the building was not designed to fit within the urban context of the evolving Town Center or intended to hold such a key position on the MD 355 corridor at the Metro gateway into the community. The retrofitted building offers very little street level activity, is low in density and turns its back to MD 355, with the frontage being primarily focused on auto and service truck access (Figure 3). This site would have greater use potential if redeveloped into a multi-story, mixed-use redevelopment offering a mix of uses, convenient transit access and additional programmed open spaces for the Town Center. Redevelopment of this site is recommended in the Town Center Master Plan.
3. **Utilities.** Large overhead utility lines and T-framed poles dominate the west side of the MD 355 corridor adding to the visual clutter and pedestrian obstacles. These older style utility systems also diminish the positive impacts that new state-of-the-art architecture, such as the Choice Hotels headquarters building at the northwest corner of Rockville Pike and Middle Lane, can have on the corridor. The utilities also limit the potential to install canopy trees along the west side of the corridor, and extend the Town Center streetscape into the corridor.



Figure 3 View of MD 355 looking north from the existing pedestrian bridge and showing the stark nature of the corridor environment. The 255 Rockville Pike site is to the left and WMATA property to the right.

4. **Inadequate Street and Pedestrian Lighting** - The corridors are primarily lit with high, pole-mounted streetlights that do well to light the roadway, but are often inadequate at providing sufficient sidewalk lighting that conveys a safe and secure image along the current urban edge of the Town Center.
5. **Inadequate Walkways** - The majority of the pedestrian walkways through the area are only plus five feet in width, with the exception of the blocks between East Middle Lane and Beall Avenue, where the walkways are 20-25 feet wide due in large part to plus ten-foot public R.O.W. coupled with a plus 15-foot setback along the west side of the MD 355 corridor for new development.
6. **Unattractive Boulevard Medians** – The MD 355 corridor functions as an urban boulevard; however, the concrete medians give the roadway a stark appearance due to the lack of distinctive paving, ground plane vegetation, lighting, or trees.
7. **Structured Parking** – Historically, the residential, civic and commercial uses along the MD 355 and MD 28 corridors relied on front door surface parking and loading areas to serve the buildings. More recent Town Center redevelopments along the corridor are now

incorporating internalized structured parking allowing the frontage and facades along the corridor to gradually begin to frame MD 355 as a front door, address street.

8. **Limited Streetscape Activation** – With the exception of the streetscape in front of the Choice Hotels headquarters, the MD 355 and MD 28 streetscapes are mostly functional in their appearance with minimum walkway and in-ground landscape planter or lawn panel dimensions, a lack of pedestrian lighting, furnishings and trash receptacles, and basic concrete sidewalk paving that are not complementary to Rockville’s Town Center setting.
9. **Connections to the Rockville Metro Station - aging pedestrian bridge crossing** – While the current pedestrian bridge linking 255 Rockville Pike with the Rockville Metro Station is both functional and direct in its design, its structural support system and spacing across MD 355 would either constrain or block the layout and construction of most BRT system alignments. Any BRT alignment concept will need to consider options for retrofitting or creating new bridge/promenade linkages to replace the current bridge. (Figure 4).



*Figure 4
Station*

Existing pedestrian bridge crossing over MD 355 to the Rockville Metro

10. **East-west Rockville divide.** For many years, the MD 355/Rockville Pike and MD 28/Veirs Mill Road corridors have been seen as thoroughfares defining the edges of east and west Rockville. When coupled with the rail lines a physical and perceptual barrier divide has been formed between east and west Rockville.

A newly designed streetscape and infill developments in association with a new Bus Rapid Transit line would help resolve many of the long-standing physical barriers and conflicts along the corridor. The introduction of BRT along the corridors could be the catalyst for the public realm changes that are needed, regardless of the final BRT approach and alignment selected.



Figure 5 Existing conditions and future visions. See Attachment G (Presentation to Mayor and Council, September 28, 2015) for application of the Rockville Town Center Master Plan to the Integration Study.

Planning Framework

Two key documents set the larger urban design context for this BRT Town Center Integration Study: the 2001 Rockville Town Center Master Plan primarily, and to a lesser extent, the 2005 Rockville Metro Station Access Study.

The 2001 Rockville Town Center Master Plan is the primary guide that conveys the image for how the City would like the MD 355 corridor to develop in the context of the Town Center (see Figure 6). A Bus Rapid Transit system was not a component of that Master Plan. This Integration Study is a starting point for determining how BRT can best fit, complement and enhance the Town Center environment along the MD 355 and MD 28 corridors.

The WMATA Metro Station sites will play a key role in the future expansion and appearance of the Rockville Town Center. WMATA's 2005 Rockville Metro Station Access Study provided the agency's internal vision of what the Metro site could become with future joint public-private redevelopment with a transit-oriented focus (see Figure 7). While neither the City nor WMATA formally endorsed or adopted the Study, the Integration Study team found it very helpful in its consideration of options and possibilities.

For the first time since these two documents were published, this BRT Integration Study molds the two visions into a single vision that incorporates Bus Rapid Transit.

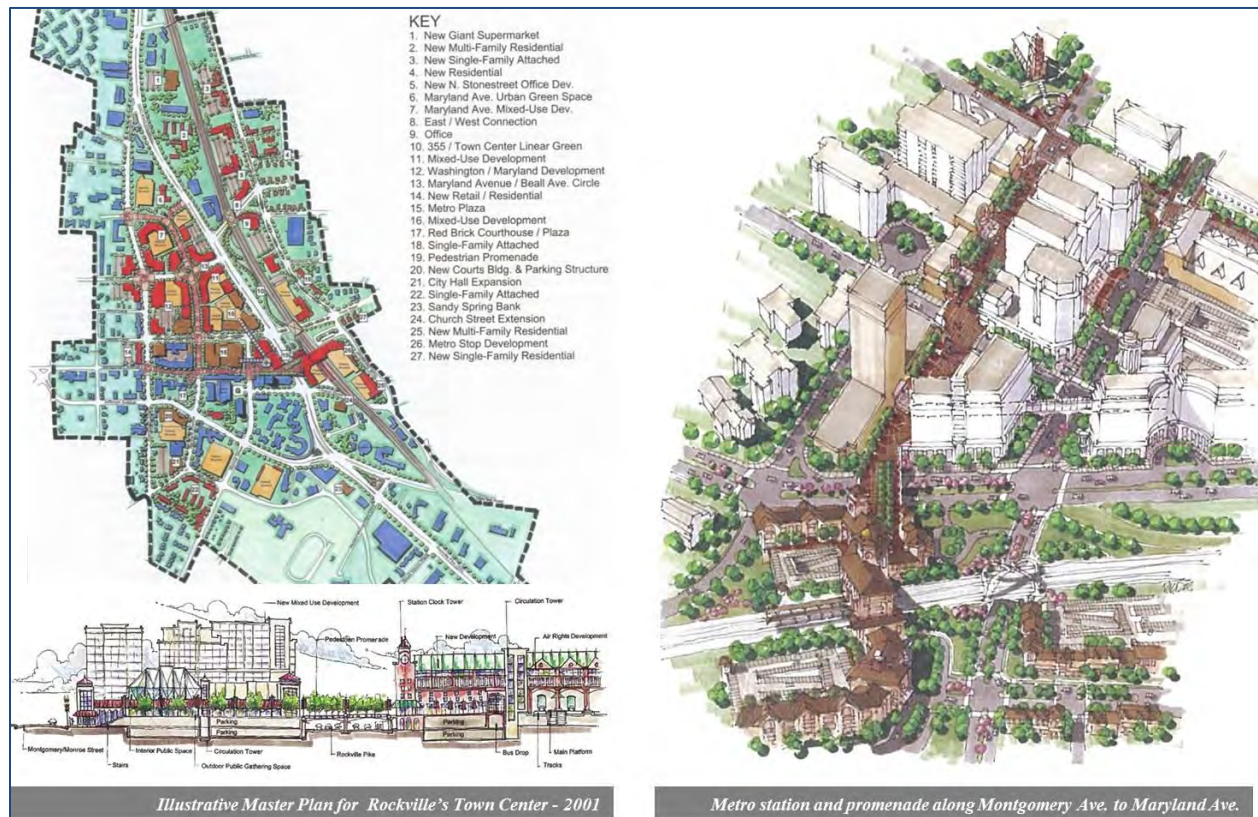


Figure 6 Sections, plans and sketches from the Rockville Town Center Master Plan were considered to set the urban context for BRT

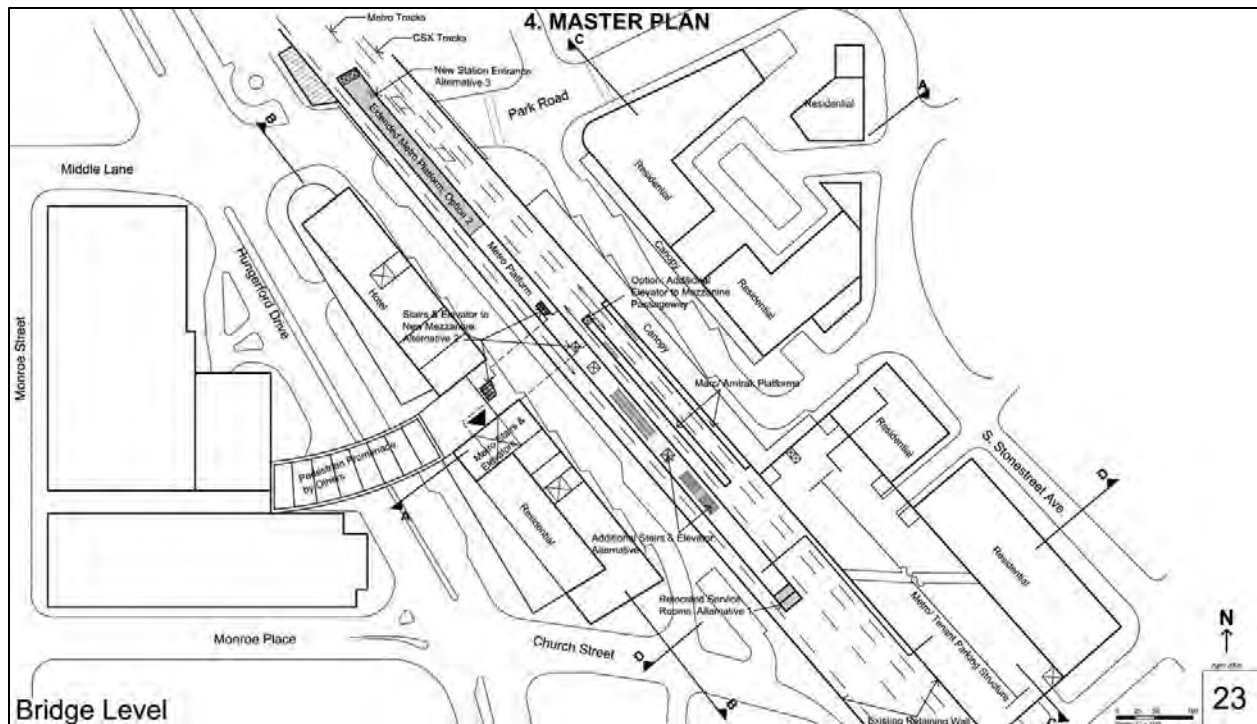


Figure 7 Plan from WMATA's 2005 Station Access Improvement Study, this study provided ideas for the Integration Study

2.2 Transportation Features

Roadways

Maryland Route 355 (MD 355) is a state owned and maintained roadway and classified as an “urban other principal arterial”. Along the project limits from North Washington Street to First Street, MD 355 encompasses eight signalized intersections. The typical section is mostly comprised of three travel lanes in each direction, with a center median and left-turn lanes at all signalized intersections. Generally, travel lanes are 11 feet wide and the posted speed limit of 40 miles per hour.

Average daily traffic volumes range between 45,000 to 50,000 vehicles per day, with peak hour peak directional volumes ranging between 2,000 to 2,500 vehicles per hour. Existing traffic count data was sourced from the Maryland State Highway Administration's Traffic Monitoring System website (http://maps.roads.maryland.gov/itms_public/). Detailed traffic volume diagrams are included in Attachments C and F.

Study area intersection capacity analysis for vehicles was performed using the Highway Capacity Manual methodology that considers roadway geometry, traffic volumes and signal timing. The key performance measure is level of service (LOS)⁴. The results indicate that two intersections (Middle Lane and Veirs Mill/ Jefferson Street) are operating at capacity (LOS D) and one

⁴ LOS is defined as a “qualitative measure describing operational conditions within a traffic stream.” LOS ranges from A to F, where a LOS A represents optimal conditions and a LOS F represents saturated or failing conditions.

intersection (Wootton Parkway) is operating at near failing conditions (LOS E). Study intersections include (Table 1):

Table 1 Intersection Level of Service

Intersection	Level of Service, 2015 (critical PM peak hour)
MD 355 at Washington Street	C
MD 355 at Dawson Lane Extended	A
MD 355 at Beall Avenue	B
MD 355 at Middle Lane/Park Road	D
MD 355 at Church Street /Monroe Avenue	B
MD 355 at MD 586/MD 28	D
MD 355 at Dodge Street /Richard Montgomery Drive	B
MD 355 at First Street/ Wootton Parkway	E

Issues and challenges

Key roadway issues include

1. Existing traffic congestion at MD 355/Middle Lane/Park Road and at MD 355 at MD 586/MD 28 (also referred to as the mixing bowl). As the current operating level of service grade at these intersections is D, there is little additional capacity to repurpose for the BRT, and repurposing roadway space for the BRT would likely result in a failing level of service.
2. Park Road to MD 355 handles a significant amount of traffic given that it serves the East Rockville neighborhood, and is one of only a few roadways in Rockville crossing under or over the WMATA and CSX rail lines. Expansion of Park Road or providing an additional crossing are unlikely.
3. Maintaining access and pre-emption to the existing fire station north of Beall without disrupting passenger vehicle or BRT operation.
4. Minimizing the impact to adjacent properties to provide dedicated transit guideways and station platform locations. Generally, the right-of-way for MD 355 and adjoining properties are built out, with narrow sidewalks abutting the roadbed and buildings or parking lots immediately behind the sidewalk.

Transit

The Rockville Metro Station is a major transit hub. The rail station/platform has over 1,000 boardings and alightings in the peak hour (<http://planitmetro.com/?s=october+2014>). In addition to Metrorail service, MARC and Amtrak service is available, as are at least 15 Metrobus and Ride On bus routes. In all, nearly 100 buses make stops at the Rockville Station in the peak hour, boarding and alighting over 1,000 passengers. While in general this heavy volume of transit service is accommodated adequately, peak period traffic can have a significant effect on bus

operations, causing lost time and lost connections for passengers. In particular, the entrances to the station bus loops from Church Street and Park Road have conflicts between buses and private automobiles⁵ (Figures 8 and 9).



Figure 8 Bus loop in front of the Rockville Metro Station.



Figure 9 Vehicles backed up seeking to exit the bus loop onto Church Street.

⁵ See Attachment C Agenda item 5 Concept Design Elements for documentation and detail.

Pedestrian and Bicycle

MD 355 is an inhospitable roadway for both pedestrians and cyclists due to the speed of prevailing traffic, the overall width of the roadway, and the narrow, exposed sidewalks along its edges in many areas.

Over 500 pedestrians currently cross MD 355 in the peak hour at either the intersection of MD 355 with Park Road/Middle Lane, or the pedestrian bridge linking the Metrorail Station to the Town Center area⁶. While the existing pedestrian bridge provides a safe way to cross MD 355, it is indirect enough that many pedestrians bypass it in favor of crossing at grade.

The only available bicycle lanes in the study are on Middle Lane and Gibbs Street although several other streets in the area are designated as shared roadways. MD 355 is slated to have either a cycle track or a shared use pathway in the future, according to the City's Bicycle Master Plan (February 2015).

⁶ See Attachment C Agenda item 5 Concept Design Elements.

3. Approach

The study approach involved six key steps:

1. Study team kick off meeting, January 8, 2015.
2. Interagency Coordination Meeting, March 4, 2015
3. Study team meetings, March 26, 2015, May 4, 2015
4. Interagency Workshop, May 21, 2015
5. Interagency Staff Workshop, August 27, 2015
6. Presentation to Mayor and Council, September 28, 2015.

The Study featured a close collaborative relationship between the City of Rockville staff from the Departments of Community Planning and Development Services and Public Works and the ERM team. ERM, Sabra Wang and Associates, and EDSA (the ERM team) and City staff worked seamlessly as a team (the Study Team) to conduct the analyses.

3.1 Study team kick off meeting, January 8, 2015

At the kick off meeting Andy Gunning summarized the prior project (Issues and Potentials Study) and status of SHA's current planning efforts. The Study team reviewed ERM's scope of work and discussed the City/Agency kick off meeting. The scope involved studying in detail a small number (most likely three) BRT design concepts that will enhance Town Center while accommodating BRT service into the area, and integrate with the Metro station and current transit service.

The team reviewed and discussed a City staff-prepared opportunities and constraints powerpoint that considered alternative options to serve Montgomery College, on the west side of MD 355. See Attachment B for detailed meeting notes and presentations.

3.2 Interagency Coordination Meeting, March 4, 2015

This meeting included the Study Team as well as representatives from Montgomery County Executive's Office, WMATA, Montgomery County Department of Transportation, Rockville City Manager's Office, State Highway Administration, Maryland Transit Administration, Montgomery County Ride-On, and Holland and Knight (the City's advisors regarding federal programs).

The City handed out a "principles" document summarizing its objectives for BRT design. These principles are:

1. BRT supports Town Center design and development goals
2. BRT expands travel options for Rockville residents, workers, shoppers and visitors
3. BRT integrates with the street network, and motor vehicle levels of service are at least maintained

4. BRT integrates with the Rockville Metro station and other transit service
5. BRT station is convenient and safe for users
6. BRT integrates with bicycle routes and users.

Attendees discussed Rockville Town Center's context and challenges and then reviewed a menu of 12 BRT configuration alternatives. These tiered off from the alternatives discussed in the Issues and Potentials Study. Attendees were invited to comment on which alternatives the City should explore in more detail in the Integration Study and which criteria the City should use in evaluating alternatives.

See Attachment C for detailed meeting notes and presentations. Within this attachment see Agenda Item 6 - Criteria Framing for a list of planning and design criteria generated at the meeting.

3.3 Study team meetings, March 26, 2015, May 14, 2015

At these meetings the team decided those alignment options and defined and refined the design elements the ERM team would develop in detail for the planned interagency workshop on May 21.

See Attachment D for detailed meeting notes that include the rationale/basis for not advancing some of the options.

3.4 Interagency Workshop, May 21, 2015

This half-day workshop included the same agencies that attended the March meeting. Six options were presented in detail, and the City invited attendees to provide input into the options to enable the City to make refinements to the options, potentially reducing the number of options for further investigation and analysis. Input was invited in the form of comment, critiques, fatal flaw identification, or additional option identification.

Attendees worked in groups reviewing the concepts that were arranged at three stations by concept type. The station with concept 5 (aerial alignment) also included concepts the City had been exploring for a transit center with an elevated bus loop/open space. The consensus recommendations were as follows⁷:

⁷ See Attachment E for detailed meeting notes

Concept	Recommendation
1. Curb Lanes –enhanced for BRT - Mixed-Traffic with far side pull-outs	No need for further study by the City in this project, but retain and present (near side pull outs⁸) as a highly feasible implementation option in the short term.
2. Curb Lanes –enhanced for BRT - Mixed-Traffic with near side pull-outs	
3. Mixed-Traffic with BRT stop in reconfigured west side station area	
4. Dedicated BRT lanes in median	Incorporate workshop recommendations and study further
5. Aerial alignment above median of MD 355	<p>Recommendations from the workshop should inform concepts 4 and 6, and potentially concepts 1, 2 and 3. These recommendations include urban design, redevelopment potential (most notably at 255 Rockville Pike), and public amenity space.</p> <p>This should include ideas from the elevated loop/ transit center concepts. This BRT integration study, although not focused on redevelopment of the Metro station property, has identified limitations the station will face when BRT is implemented.</p>
6. Dedicated lanes in median with through traffic in tunnel.	Incorporate workshop recommendations and study further

3.5 Interagency Staff Workshop, August 27, 2015

This half-day workshop included staff from the County’s Department of Transportation and Executive’s Office. The purpose was to review progress on engineering design for BRT options 2, 4, and 6, present changes compared to what had been presented on May 21, receive staff input and discuss next steps with respect to a presentation to Mayor/Council scheduled for September 28, 2015.

ERM team member Sabra Wang reviewed work done by the SHA in 1998 to 2000. The team felt that this relatively recent work should be borne in mind as the Study team contemplated potentially broad options for MD 355.

ERM team member EDSA presented a variety of design ideas to integrate the BRT options with the City’s physical development interests including the Town Center Master Plan. EDSA observed that SWA had taken the general approach (across all options) of adding BRT while seeking to minimize the need to acquire additional right of way. This was an appropriate

⁸ A near side bus stop is a stop located along the curb in advance of an intersection, typically at the stop bar.

approach for baseline engineering but from an urban design perspective EDSA was not able to add design amenities without increasing the potential right of way needed, though EDSA felt this could be mitigated and/or be made acceptable to property owners. EDSA's intent in part was to make a design statement rather than simply "fitting BRT in".

See Attachment F for detailed meeting notes and presentation materials.

3.6 Presentation to Mayor and Council, September 28, 2015

The Study Team made a one-hour presentation to the Mayor and Council. The presentation included descriptions of operational and design considerations for the three selected options:

- BRT in mixed traffic (Option 2)
- BRT in a dedicated median on MD 355 (Option 4)
- BRT in a dedicated median on MD 355, through traffic in a tunnel (Option 6)

For each option the team presented the operational and urban design features, and the presentation concluded with a comparative summary of key operational and urban design considerations, conclusions and next steps.

See Attachment G for the meeting Powerpoint presentation. The presentation was recorded and can be viewed at <http://rockvillemd.gov/AgendaCenter/Mayor-and-Council-5>

4. BRT Options Selection

As described in Section 2, the starting point for options selection was the 12 options⁹ presented at the March 4, 2015 interagency meeting. These were, essentially, the universe of options and were derived mainly from the Phase I Issues and Potentials Study. Variants and refinements emerged during the Integration Study. The 12 options were:

1. Mixed Traffic – MD 355
2. Mixed Traffic with Priority (Queue Jumps and Signal Priority) –MD 355
3. Lane repurposing –MD 355
4. New Managed Lane –median reversible flow – MD 355
5. New Dual Dedicated Lanes – Median – MD 355
6. New Dual Dedicated Lanes – Side Running – MD 355
7. New Dual Dedicated Lanes – Frontage Road– MD 355
8. Exclusive Bus Guideway – MD 355 Elevated Aerial
9. Exclusive Bus Guideway – MD 355 Tunnel
10. Mixed in Local Only –MD 355 with exclusive through traffic lanes - MD 355 Tunnel

⁹ Actually 13, counting 10 and 10b separately.

- 10b Local traffic and exclusive bus lanes at grade, through traffic grade separated – MD 355
- 11. Mixed Traffic – West Side via Middle Lane, Washington Street and Montgomery College ROW
- 12. Mixed Traffic – East Side via South Stonestreet Avenue

At meetings on March 26 and May 14, the Study team decided to advance numbers 2, 4, 5, 8, 10b, and 11 for further detailed study. These were later renumbered and then refined as 1 through 6 for use at the May 21 workshop, as follows: (see Attachment D)

- 1. Mixed-Traffic with far side pull-outs
- 2. Mixed-Traffic with near side pull-outs
- 3. Mixed-Traffic with BRT stop in reconfigured west side station area
- 4. Dedicated lanes in median
- 5. Aerial alignment above median of MD 355.
- 6. Dedicated lanes in median with through traffic in tunnel.

Based on the Study principles and the planning and design criteria the team decided to not advance the other options (from the original 12), per the following listing.

Options not advanced	Comments/rationale for not advancing
1. Mixed Traffic	SHA will likely assess.
3. Lane Repurposing	Too disruptive to roadway level of service, and SHA will likely assess.
4. New Managed Lane – Median Reversible Flow	Concerns about impact of a single lane on frequency, headway and service levels?
6. Dual Dedicated Lanes – Side Running	Likely unacceptable right of way impacts and operational issues due to business access and turning movements. Would be difficult for southbound buses to continue on MD 355 through “mixing bowl” intersection.
7. New Dual Dedicated Lanes – Frontage Road	Likely unacceptable right of way impacts and operational issues due to business access and turning movements. Would be difficult to access Metro station from southbound BRT lanes.
9. Exclusive bus guideway (tunnel)	Cost will not justify benefit. Would also require underground changes at Metro station
10. Mixed in Local Only – MD 355 with exclusive	Does not meet intent to separate BRT from traffic where feasible.

Options not advanced	Comments/rationale for not advancing
through traffic lanes	
12. Mixed Traffic – East Side via Stonestreet Avenue	Stonestreet Avenue may be workable in some respects, but alignment will not meet key criterion of reinforcing Town Center.

At the May 21 Interagency Workshop, there was general agreement to advance three concepts for further study (see Attachment E):

2. Mixed-traffic with near side pull-outs
4. Dedicated lanes in median
6. Dedicated lanes in median with through traffic in tunnel.

The following section describes these options in more detail.

5. BRT Options Studied in Detail

This section describes Concepts 2, 4, and 6. For additional detail see Attachment G - Presentation to Mayor and Council, September 28, 2015 and Attachment H (Engineering Drawings).

5.1 Concept 2 Mixed-traffic with near side pull-outs¹⁰

Roadway / BRT Design Elements

BRT service would operate in mixed-traffic curb lanes on either side of MD 355 through the study area (Figure 10). Where possible, curbside enhancements including queue jumps (allowing buses to proceed ahead of other traffic stopped at intersections) with signal priority for BRT vehicles, and pull-out platform locations would be included throughout the length of the BRT corridor. Within the study area, queue jumps with signal priority would be at Church Street (northbound direction only) and at Park Road/Middle Lane in both directions. The queue jumps and signal priority at Park/Middle would form direct egress for BRT vehicles leaving the northbound and southbound platforms, eliminating the possibility of the buses being blocked in by traffic except in the very worst conditions. Transit-only queue-jump lanes and pullouts would be designated through pavement marking and signage. Figure 11 shows the queue jump at Church Street, and Figure 12 shows the dual queue jumps and the pull-out platform locations at Park Road/Middle Lane. These figures are details extracted from the engineering drawings in Attachment H.

This concept would also accommodate the Veirs Mill Road BRT with platforms providing sufficient length in the northbound direction. BRT service returning to Veirs Mill Road from this station could make a series of right turns onto Park Road and then Stonestreet Avenue in order to merge back onto Veirs Mill Road in the eastbound direction. Alternatively, service could also continue up MD 355 to Montgomery College.

Concept 2 would not affect the existing lane configuration of MD 355, or bicycle or ADA accommodations in the corridor. The southbound station platform would be a minimum of eight feet wide, and the northbound platform would be at least twelve feet wide. Both would serve dual purpose as passenger boarding and alighting area and as the sidewalk for MD 355.

¹⁰ A near side bus stop is a stop located along the curb in advance of an intersection, typically at the stop bar.

Figure 10 Concept 2 Mixed-traffic with near side pull-outs



Note: for detailed drawings see Attachment H

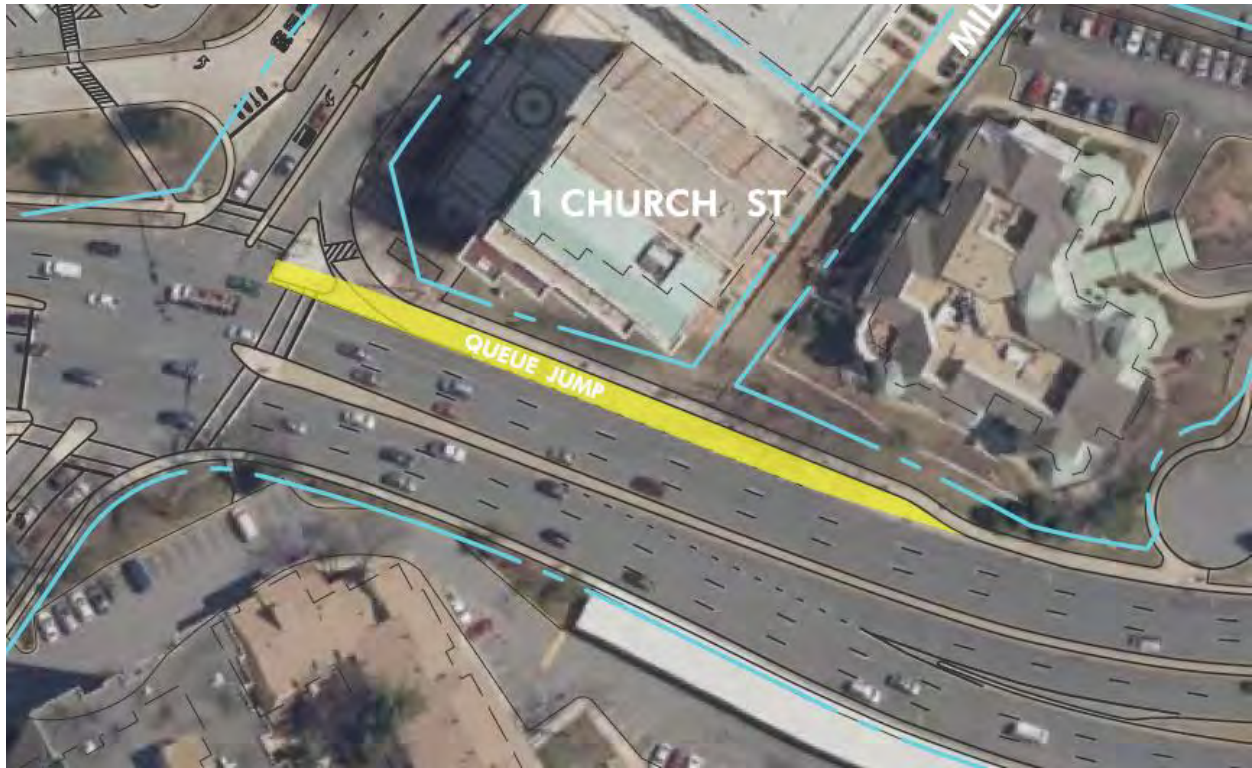


Figure 11 Northbound queue jump at Church Street

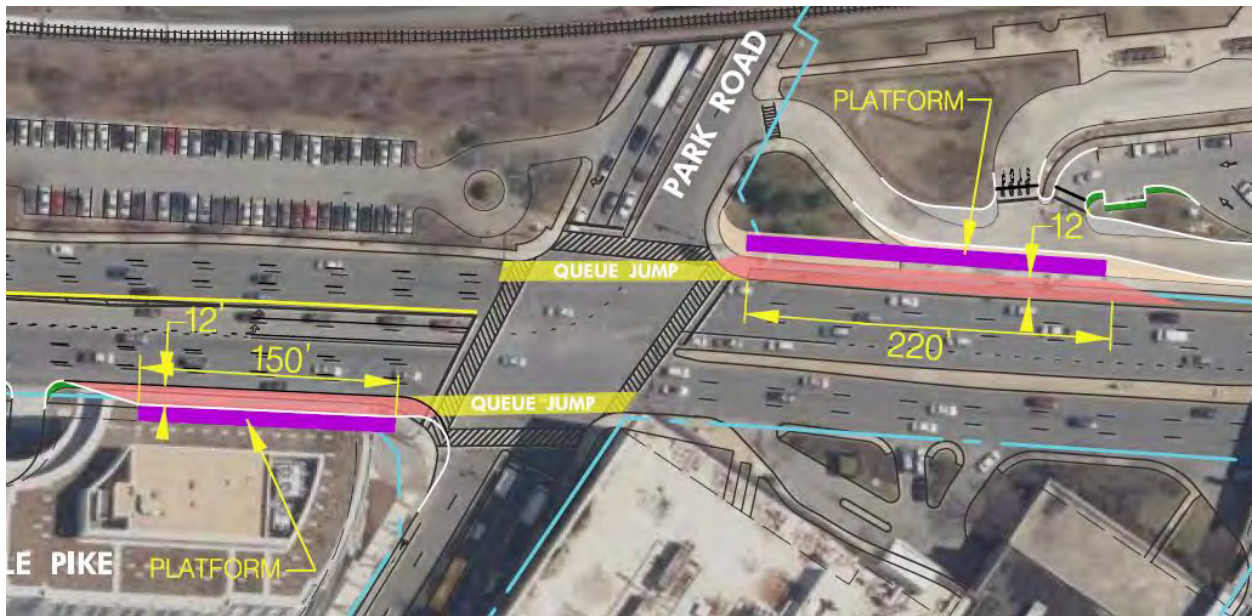


Figure 12 The northbound and southbound BRT station platforms, showing pullouts and queue jumps

Stations, Connections

One station would be located within the study area, at the intersection of MD 355 and Park Road/Middle Lane, given its close proximity to the Metro station, the pedestrian circulation it would support, and the physical space to accommodate the station and platforms needed. Platforms would be at-grade curbside, and 12'-wide pullouts would be provided. The northbound platform would be approximately 220' long, providing sufficient space for up to three 60-foot long BRT buses to stop there simultaneously, which would be important given the need to accommodate Veirs Mill BRT service as well. Due to space constraints between the MD 355/Middle Lane intersection and the Choice Hotels headquarters entrance, the southbound platform would only be 150' long. That length would allow for two BRT vehicles stopping simultaneously.

The northbound platform would be directly adjacent to the Rockville station bus loop, which would have to be modified slightly to accommodate the platform. Direct pedestrian access could thus be provided to Metrorail, MARC, Metrobus & Ride On, as well as to park & ride and kiss & ride facilities. The southbound platform would be separated from these amenities by MD 355, though it would be immediately accessible to the Town Center area.

Utilities, Stormwater

Concept 2 would have minimal impact to existing utilities, although utility poles in front of the Choice Hotels headquarters building would need to be relocated. Any additional impervious surface created by the platform or queue jump lane may be eligible for a waiver from storm water mitigation due to the small area of impact.

Operations

A traffic evaluation of Concept 2 found that it would not change the existing intersection level of service at any of the study intersections (see Table 1 above). The concept envisions signal timing adjustments including transit signal priority for BRT vehicles and leading walk intervals¹¹ for pedestrians at the Middle Lane/ Park Road intersection.

Running BRT vehicles in mixed traffic in this area would result in service variability and unreliability in travel time along the BRT corridor, due to the inability to circumvent passenger vehicle traffic congestion and delays. Queue jumps at intersections may help offset this somewhat.

Curbside BRT configurations may provide enhanced safety benefits to pedestrians, since they do not always have to cross streets to board the bus. In addition, for the northbound BRT, there is a direct connection to the Metro Station property since the platform would be on the east side of Rockville Pike.

¹¹ A leading WALK interval is 3-4 seconds of a pedestrian WALK phase prior to any vehicle green signal indication to give pedestrians a head start and higher visibility into a cross-walk.

Right of Way

Approximately 6,575 SF (0.15 acres) of additional right-of-way from WMATA property would be required for Concept 2. (Attachment I)

Cost

Construction cost estimates were developed for each concept using SHA's Major Quantities Estimates methodology. The project cost for Concept 2 is estimated to be \$1.2 million (see Attachment J for the cost estimate break down).

Major Quantities Estimates are used to estimate construction costs during the planning stage and early in the preliminary engineering stage. The idea is to estimate as accurately as possible those categories that can be estimated in the very early stages such as grading, paving, structures and shoulders items and compute the remaining categories as percentages of those categories. A total of ten categories were used for estimates.

The cost estimate does not include right of way or utility undergrounding/relocation costs although they may be covered under percentage-based items/contingencies.

Station costs can vary widely depending on location (side or median) features, and amenities. Capital cost estimates prepared in July 2015 for the County Executive's Transit Task Force showed station costs ranging from \$0.95 million to \$4.3 million (see Attachment J). The cost estimate for a curb side/mixed traffic station comparable to this Integration Study's Concept 2 was \$0.95 million.

Urban Design – Town Center integration opportunities

Compared to Concepts 4 and 6, the mixed-traffic BRT alignment discussed in this section would require fewer, but no less important, physical changes to accommodate new BRT Stations and intersection queue jumps within a concentrated area along MD 355 between MD 28/Veirs Mill Road to the south and Beall Avenue to the north. Figure 13 illustrates a series of potential urban design improvements that could be introduced along the corridor in association with this early phase, mixed-traffic approach to BRT on the MD 355/MD 28 corridors.



MD 355 Urban design focus area at WMATA Rockville Metro Station

Improvements would likely include (see numbers on Figure 13):

1. ***Improved crosswalks and pedestrian refuges*** in medians at East Middle Lane/Park Road and Monroe Place/Church Street Intersections. Crosswalks could be uniformly expanded and newly paved or striped to increase visibility and reduce conflicts between pedestrians and vehicles. The crosswalks could lead to new pedestrian refuge areas located within landscaped and tree-lined medians, offering pedestrians a safe place to rest when crossing the multi-lane boulevard.
2. ***Improved streetscape walkway environs*** along both sides of the MD 355 and MD 28 corridors between Beall Avenue and Veirs Mill Road that would complement and extend the character of the Town Center streetscape created in front of the Choice Hotels headquarters building. This could include a new streetscape palette of wider walkways pulled away from the roadway curbs with planted tree lawns or in-ground tree planters, complemented by pedestrian-oriented lighting, street furniture, and trash receptacles at crossings and waiting areas.
3. ***Continuous planted medians*** in place of the current concrete medians between northbound and southbound auto travel and turn lanes that would help to soften the amount of paving, beautify the new boulevard setting, provide areas for pedestrian crossing refuges, stormwater management and tree planting for shade along a greener boulevard.
4. ***Potential areas for improved and creative stormwater management*** in and around the Rockville Metro Station facilities in the form of bioswales, above and below-ground retention areas that could support and showcase Rockville's and WMATA's commitment to sustainable transportation and transit development practices.



Figure 13 Concept illustrating the potential urban design opportunities with BRT in Mixed Traffic on the MD 355/Rockville Pike corridor

5. ***New curbside, low-profile BRT station platforms with transit rider amenities*** such as all-weather transit shelters, adequate seating for waiting patrons, posted maps and schedules for orientation, and digital messaging with apps for tracking real time BRT bus arrivals and departures (See Figure 14).
6. ***Public art installations*** as a component of the BRT station platforms and architectural shelter design to convey Rockville, Montgomery County and the MTA's support for the art in public spaces movement in modern transportation facilities.
7. ***Realignment of the WMATA parking lot and drop-off/pick-up area improvements*** north of Park Road to accommodate a slight widening and realignment of the MD 355 corridor to the east making additional sidewalk space for a BRT Transit shelter in front of the Choice Hotels headquarters building.
8. ***Potential future extension of the Metro Station platform*** over Park Road to provide more direct secondary access between the northern portion of Rockville Town Center and the Rockville Metro Station. This element was in WMATA's 2005 Rockville Station Access Improvement Study.
9. ***Partial realignment and reconstruction of WMATA's Metro Station facilities*** including: the Park Road entrance drive, Kiss 'n' Ride exit lane and Metrobus loop that converge along the east side of MD 355-Rockville Pike.

These items would collectively improve pedestrian and transit rider safety while having the added advantage of transforming the image of this portion of the corridor as a prototype for what the remainder of the corridor could become in the future.



Figure 14 Sample urban design improvement opportunities for “mixed-traffic” BRT alignment

5.2 Concept 4 Dedicated lanes in median

Roadway /BRT Design Elements

BRT service would operate in a median guideway, which would be primarily dual lane but would also have limited sections of bi-directional single lane where the need to preserve mixed traffic left-turning lanes is critical, such as at East Jefferson Street and at Middle Lane (Figure 15). At these locations, bi-directional lane sections would incorporate designated “stop and wait” locations where BRT drivers would be able to clearly see any bus serving the one-lane section in the opposite direction. Platforms would be at-grade in the median, located immediately adjacent to an intersection.

Dedicated BRT lanes would be 12’ wide, and BRT platforms would be a minimum of 8’ wide. The lane configuration of MD 355 would not be affected by this concept, although lanes would be shifted outward, particularly north of Park Road. The need to relocate sidewalks due to increases in right-of-way would present opportunities to improve pedestrian facilities (see below under Urban Design).

The Concept does not include bicycle lanes in this section of MD 355 given the space limitations, safety concerns and connectivity challenges in either direction. The study team sees parallel roadways such as Washington Street, Maryland Avenue, and Stonestreet Avenue as better bicycle routes.

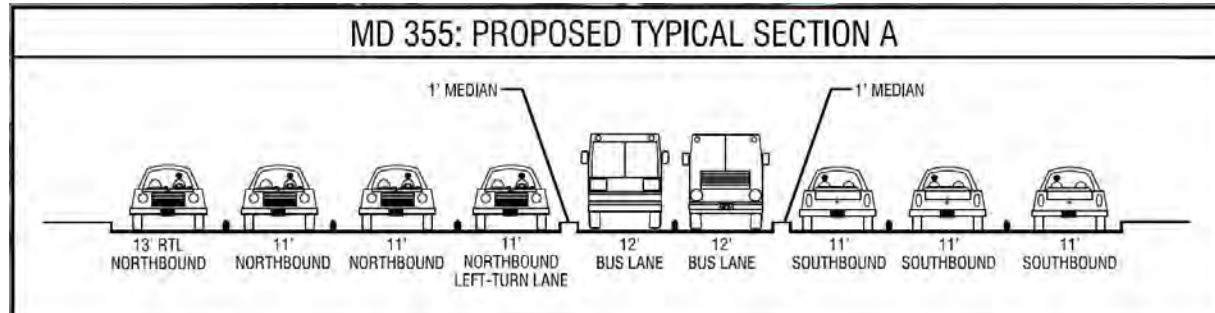
Other noteworthy design elements/accommodations include:

- Three travel lanes are maintained throughout in each direction. Left turn lanes are preserved where they currently exist. When two BRT lanes are incorporated, the result is a wide cross section.
- Left turns by emergency vehicles facilitated by breaks in medians, and traffic signal north of the firehouse.
- Loss of service lane between WMATA north lot and Washington Street.
- Split northbound and southbound platforms on either side of Middle Lane.
- Some loss of WMATA property necessary, shift of WMATA north lot away from MD 355.

Figure 15 Concept 4 Dedicated lanes in median



See below for enlargement of inset. Note: for detailed drawings see Attachment H.



Stations, Connections

The one station in the study area would be located at the intersection of MD 355 with Park Road/Middle Lane given the proximity of the Metro station. The northbound platform would be located just north of the intersection and the southbound station would be located just south of the intersection. The northbound and southbound platforms would be approximately 100' long and 8' wide. Unlike Concept 2, with the buses running in the median the passenger platform must also be located in the median. While these lengths would only accommodate a single BRT vehicle stopping at any given time, the “stop and wait” configuration would make incidence of multiple buses serving the platform simultaneously unlikely. The station area would be a bi-directional segment of roughly 300'-400' in length, including the width of the intersection (Figure 16).

Both platforms would be separated from the Rockville Metro Station by the northbound lanes of MD 355. Pedestrian access would be provided to Metrorail, MARC, Metrobus & Ride On, as well as park & ride and kiss & ride facilities via the existing crosswalk at Middle Lane.

Preliminary analysis indicates that pedestrian volumes crossing between the BRT platforms and both sides of MD 355 would be much heavier than current volumes (see Attachment F). This would introduce potential conflicts between pedestrian activity and vehicle turning movements at the MD 355/Park Road/Middle Lane intersection. Detailed analysis and modeling of pedestrian flows in this area are recommended before the design of this concept is finalized.

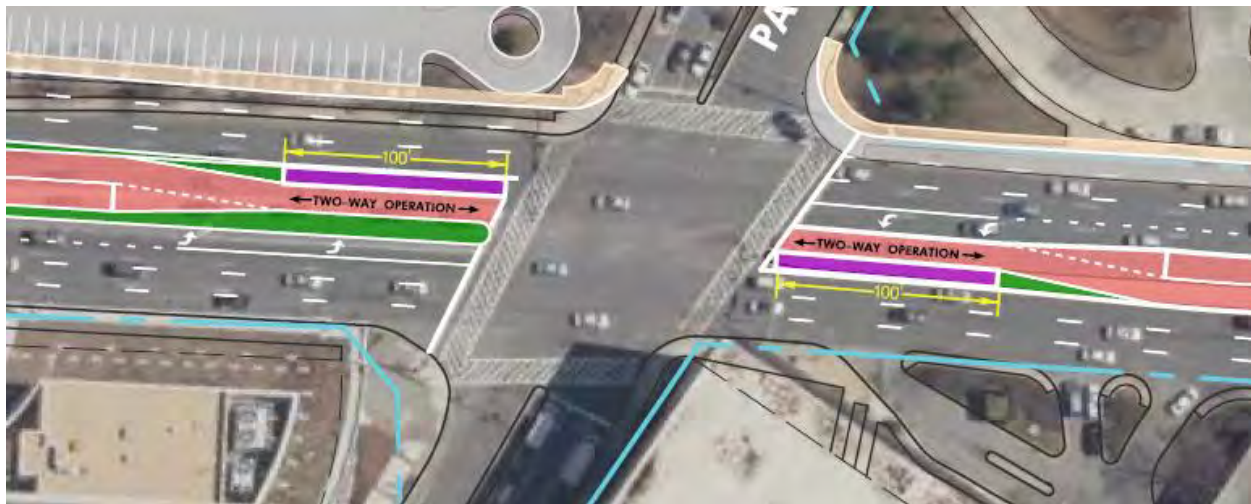


Figure 16: Station platforms for Concept 4.

Utilities, Stormwater

Existing utilities that are within the study area and that may be disturbed and need removal/abandonment and replacement include: overhead and underground electric, telephone and cable lines; underground communication lines; roadway lighting, stormwater pipes and inlets; public water pipes; sewer pipes and manholes; and gas lines. (See the Rockville BRT Station Integration Map Atlas in Attachment C).

All stormwater piping and inlets would have to be removed and replaced where roadway widening is proposed. All overhead telephone lines would be either replaced on relocated utility poles or buried underground. All overhead electric lines (primary voltage and feeder lines) and overhead telecom and fiber lines would be either replaced on relocated utility poles or buried underground.

The utility poles in this corridor also have standard “cobra head” street lighting arms and lamps. If the utility poles are relocated, the arms and the lamps may need to be upgraded. If the utilities are placed underground, *new* street lighting will be required for the corridor. Supply lines may need to be rebuilt and/or relocated to different locations of buildings necessitating internal electrical retrofits.

The study team estimated the net change in impervious surface area under Concept 4, limited to the extent of future ROW and not including redeveloped private property. A total of 40,500 SF or 0.95 acres of impervious surface would be added and need mitigation¹². This calculation assumed that new medians separating the bus lanes from the vehicle lanes would be impervious.

Stormwater BMP (Best Management Practice) options can mitigate new impervious surface and/or capture run-off at the point of generation.

1. Design for a reduction in impervious pavement. For example, constructing medians to be fully or partially pervious would reduce the net increase in run-off.
2. Porous pavement/pavers and structural soil cells can be used in the frontage medians where bus stop and alighting/boardings areas are located and other locations such as the sidewalk zone.
3. Bio-retention and infiltration cells, designed into new frontage and center medians. For example:
 - Stormwater capture and infiltration can be built into urban tree pits proposed to line the frontage median and sidewalk furniture zone.
 - The center medians can be designed to accommodate extra stormwater capacity in underground storage cells/ cisterns or by partial conversion to a bioswale.

Operations

BRT operations, running in dedicated lanes, could accommodate the projected passenger vehicle level of service and would run as envisioned in the BRT service plans (see Section 1.3).

The platform location in the median of Rockville Pike would require all pedestrians boarding or alighting the BRT vehicle to cross at least 3 lanes of the roadway. In addition, with boardings and alightings anticipated to approach 1,000 passengers per hour under design year (2040)

¹² Calculations based on Chapter 5 of the latest revision of the 2010 Maryland Department of the Environment (MDE) Stormwater Management Guidelines. Chapter 5 contains the regulations for managing 100% of the existing flow plus 50% of the proposed development flows by calculating the impervious and pervious surfaces so as to best manage the volume of water at specific points of interest at the right-of-way and property lines.

ridership levels, platform crowding and ADA access would need to be further studied in the design phase if this alternative were advanced (see PM Peak Hour Pedestrian Activity slide in Attachment G).

Intersection capacity analysis for vehicles under Concept 4 was performed using the Highway Capacity Manual methodology, adding BRT to existing traffic (i.e., not projected future traffic). The results indicate that one intersection only, MD 355 at Middle Lane, would deteriorate; from a LOS D to a LOS E (Table 2). The change in LOS is due to the elimination of one of the two existing southbound left-turn lanes to accommodate the BRT footprint. None of the other intersections would have lane assignment changes under this concept and are not anticipated to experience changes in LOS.

Table 2 Intersection Level of Service

Intersection	Existing Level of Service, 2015 (critical PM peak hour)	Concept 4 PM Level of Service
MD 355 at Washington Street	C	C
MD 355 at Dawson Lane Extended	A	A
MD 355 at Beall Avenue	B	B
MD 355 at Middle Lane/Park Road	D	E
MD 355 at Church Street /Monroe Avenue	B	B
MD 355 at MD 586/MD 28	D	D
MD 355 at Dodge Street /Richard Montgomery Drive	B	B
MD 355 at First Street/ Wootton Parkway	E	E

Right of Way

Concept 4 would impact 13 property parcels and require approximately 28,500 square feet (0.66 acres) of additional right-of-way (Attachment I).

Cost

The project cost for Concept 4 within the study area is estimated at approximately \$30.1 million, using the SHA's Major Quantities Estimates methodology. (See Attachment J for the cost estimate break down, and Concept 2 for exclusions. The cost estimate does not include right of way or utility undergrounding/relocation costs although they may be covered under percentage-based items/contingencies.

As noted above, station costs can vary widely depending on location (side or median) features, and amenities. Capital costs prepared in July 2015 for the County Executive's Transit Task Force estimated the cost of a station for a two-lane median BRT with 4 travel lanes at \$3.6 million, and with six lanes at \$4.3 million. The Concept 4 station is a split station design, with platforms in two locations on either side of the Park Road /MD 355 intersection, and this would affect the cost. (see Attachment J)

Urban Design – Town Center integration opportunities

Since concept 4 would result in significant expansion and realignment of the right-of-way and roadway, it offers an opportunity for continuous public realm and urban design improvements to be considered throughout the MD 355 and MD 28 corridors within the Town Center area.

Reconfiguration of both corridors would offer the opportunity and spark to upgrade the aging aesthetic, safety and functional elements along the corridors that would in turn help to improve the image, use and visitation to the area for Rockville’s residents, workers and visitors. Figures 17 and 18 illustrate a series of potential urban design improvements that could be introduced along the corridor in association with this concept. Improvements could include:

1. ***Improved crosswalks and pedestrian refuges*** in medians at all signalized crossings along the corridor. Crosswalks could be uniformly expanded and newly paved or striped to increase visibility and lower conflicts between pedestrians and vehicles. The crosswalks could lead to new pedestrian refuge areas located within landscaped and tree-lined medians, offering pedestrians a safe place to rest when crossing the multi-lane boulevard or linking transit riders with the centerline BRT waiting and loading area platform(s).
2. ***Improved streetscape walkway environs*** along both sides of the MD 355 and MD 28 corridors that complement and extend the character of Rockville’s Town Center interior streets. This could include a new streetscape palette of wider walkways pulled away from the roadway curbs with planted tree lawns or in-ground tree planters, complemented by pedestrian-oriented lighting, street furniture, and trash receptacles at crossings and waiting areas.
3. ***Continuous planted medians*** between the dedicated BRT lanes and the neighboring auto travel lanes that would help to soften the amount of paving, beautify the new boulevard setting, provide areas for pedestrian crossing refuges and better define modes of travel along the corridors.
4. ***Potential areas for improved and creative stormwater management*** would need to be identified and programmed along the corridors in the form of bioswales, above and below-ground retention areas, park spaces, etc. that would showcase Rockville’s commitment to sustainable development practices.
5. ***New low-profile BRT station platforms with transit rider amenities*** such as all-weather transit shelters, adequate seating for waiting patrons, posted maps and schedules for orientation, and digital messaging with apps for tracking real time BRT bus arrivals and departures.
6. ***Public art installations*** as a component of the BRT station platform and architectural design to convey Rockville’s, Montgomery County’s, and the MTA’s commitment to the art in public spaces movement in modern transportation facilities.
7. ***Realignment of the WMATA parking lot and drop-off/pick-up area improvements*** north of Park Road, coupled with a potential future extension of the Metro Station platform over Park

Road to provide more direct secondary access between the northern portion of Rockville Town Center and the Rockville Metro Station.

8. ***Partial realignment and reconstruction of WMATA's Metro Station facilities*** including; the Park Road entrance drive, Kiss 'n' Ride area and Metrobus lay-by area that abut the east side of MD 355-Rockville Pike
9. ***A new pedestrian bridge and/or promenade*** replacement linking Montgomery Avenue, the 255 Rockville Pike site and the 51 Monroe Place office towers with the Rockville Metro Station. The new travel lane and median alignments, as well as the overall width of right-of-way required for Concept 4 would require the existing pedestrian bridge and its structural support to be significantly modified or replaced with a more modern equivalent that could also be a gateway statement into Rockville Town Center. This is discussed further in Concept 6 below.



Figure 17 Comparison of existing MD 355 corridor conditions and a sample dedicated BRT corridor with lanes and medians



Higher visibility and widened crosswalks



Strategic locations for Rockville's public art & monuments program



Sidewalk improvements with street trees, pedestrian lighting & site furniture



Landscaped medians



Custom transit shelters with public art incorporated within



ADA accessible loading platforms



Provision for bike loading to encourage multi-modal trips

Figure 18 *Sample urban design improvement opportunities for “dedicated median lane”, Concept 4 BRT alignment*

Two major improvement opportunities that could be sparked by the introduction of BRT along the corridor are future private redevelopment of the 255 Rockville Pike site and possible joint public-private redevelopment of the west side of the WMATA Rockville Metro Station site. Carefully coordinated redevelopment of these two sites with appropriately scaled, transit-oriented development, land uses and clear extensions of the public realm items discussed above, integrating with the Town Center environs would provide new quality of life offerings for Rockville. A vision for what the MD 355- Rockville Station West Side could look like with the introduction of BRT and redevelopment is illustrated in Figure 19 (see additional sketches in Attachment G).



Figure 19 Sketch looking southeast showing improvements under Concept 4 (and 6): Dedicated Median Lanes BRT alignment

5.3 Concept 6 Dedicated lanes in median with through traffic in tunnel.

Roadway / BRT Design Elements

This alternative advances the concept suggested in the Town Center Master Plan as a long-term solution to dealing with through traffic on MD 355, while accommodating the new BRT investment needed to make this critical juncture in the BRT network fully functional. In the concept, through traffic on MD 355 would be diverted to a 0.70 mile long four-lane tunnel from south of Dodge Street and north of Beall Avenue (see Figure 20). Existing at-grade travel lanes would be reconfigured to provide two through lanes in either direction, turn lanes and a two-lane buffered BRT guideway in the median of MD 355. Tunnel entrances would be staggered in order to minimize the need to increase the roadway total width (see Figure 21 and 22). The result would be a net gain of one additional vehicle travel lane in each direction.

Dedicated BRT lanes would be 12' wide, and the BRT single center island platform would be a minimum of 8' wide. The need to move sidewalks, as well as the reduced traffic level on fewer surface lanes of MD 355, present significant opportunities to improve pedestrian facilities and redesign the corridor as a more urban place and a multimodal spine for downtown Rockville.

This concept has the potential for on-road bicycle lanes along MD 355 due to lower surface street vehicle traffic volumes and additional roadbed space reallocated due to the tunnel.

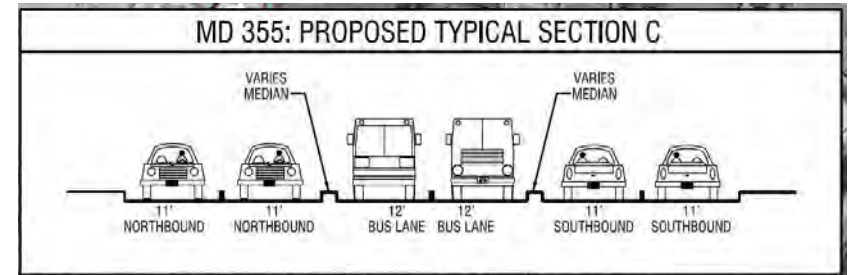
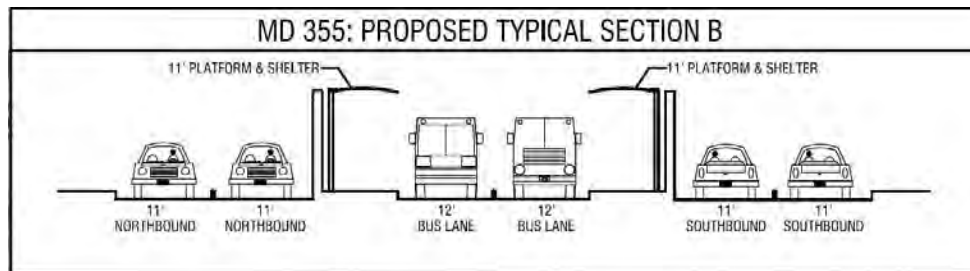
Additional design elements include:

- Left turns by emergency vehicles facilitated by breaks in medians, stop signal north of firehouse.
- Left turn lanes preserved where they currently exist, with the exception of Mount Vernon Road which would be closed at the median to left turns to and from MD 355.

Figure 20 Concept 6 *Dedicated lanes in median with through traffic in tunnel.*



See below for enlargement of insets. Note: for detailed drawings see Attachment H.



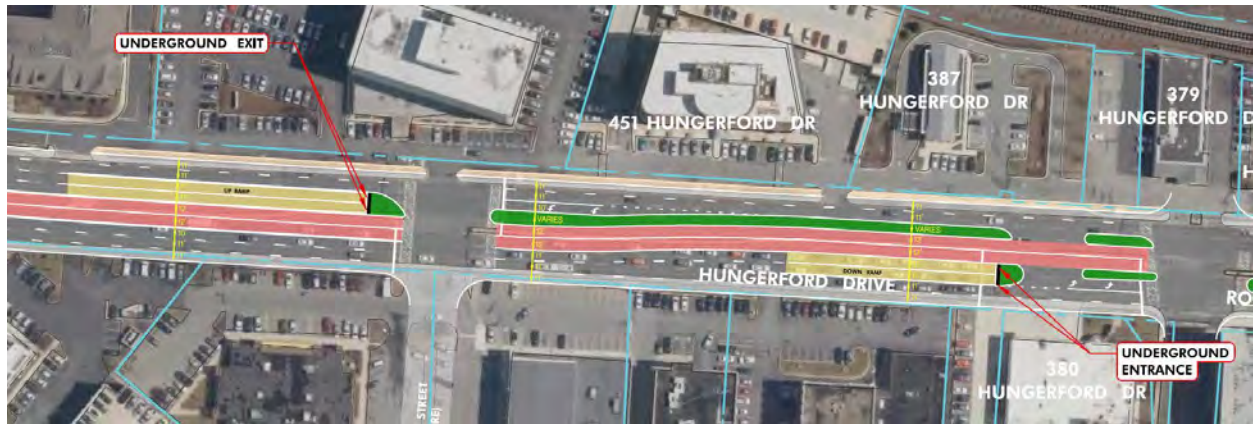


Figure 21 Entrance and exit ramps at northern end of the tunnel

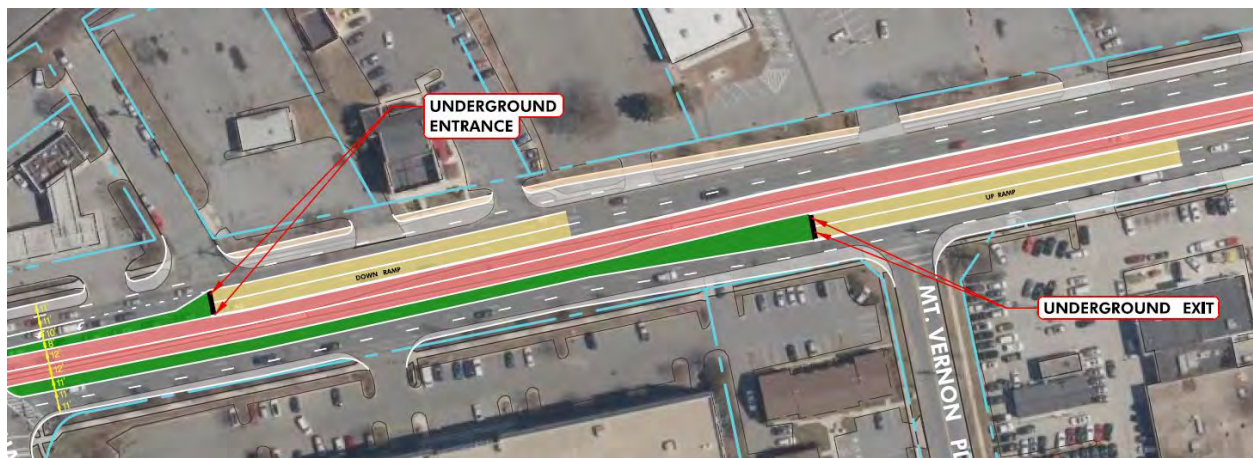


Figure 22 Entrance and exit ramps at southern end of the tunnel

Stations, Connections

The one station in the study area would be located south of the intersection of MD 355 with Park Road/Middle Lane immediately in front of the Metro Station (Figure 23). Concept 6 has additional road space due to the reduced number of through travel lanes to allow for wider medians such that a single center island platform would serve both directions, and BRT vehicles would serve the station with left-side doors exclusively. The center platform would be a minimum of 150' long, and between 12' and 20' wide, providing space for a comfortable passenger waiting area with amenities. The center platform configuration would provide easy transfers between northbound and southbound BRT vehicles, an important consideration at this station where the MD 355 and Veirs Mill BRT lines will come together. Transfers would be easier than in Concept 4 which has staggered and relatively narrow platforms requiring pedestrians to cross multiple streets to connect between BRT platforms.

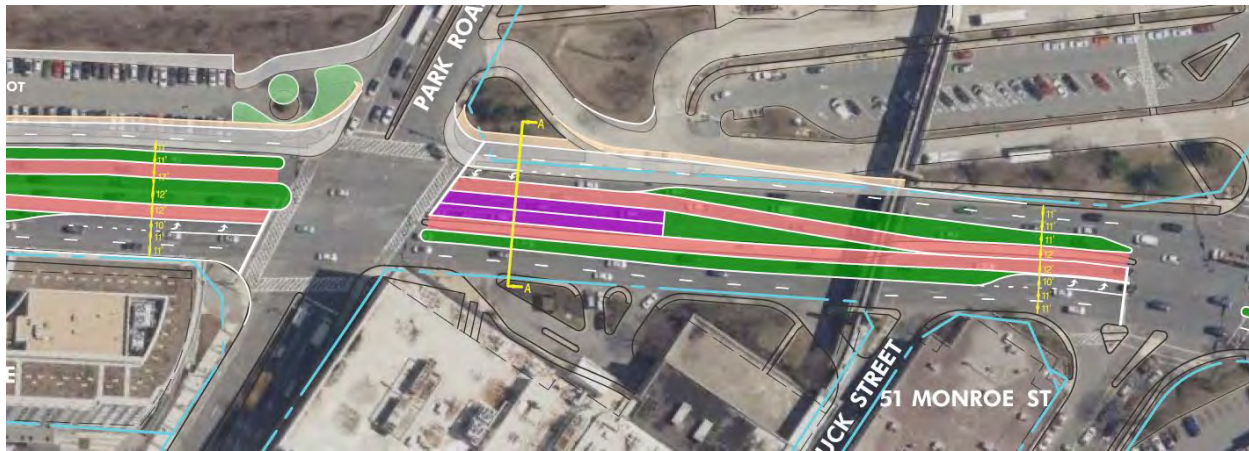


Figure 23 Concept six BRT platform configuration

Both platforms would be separated from the Rockville Metro Station by the northbound lanes of MD 355. Pedestrian access would be provided to Metrorail, MARC, Metrobus & Ride On, as well as park & ride and kiss & ride facilities via the existing crosswalk at Park Road. But with MD 355 as a 4-lane complete street, gaining access to the Metro Station from the median BRT station and vice versa would be more manageable for pedestrians. See below, under Urban Design for additional pedestrian access concepts.

Utilities, Stormwater

The construction of a 0.70 mile-long tunnel would involve extended and extensive construction with potential major delays to motorists, inconveniences to businesses, pedestrian access and costly utility relocations. Existing utilities that are within the study area and that may be disturbed and need removal/abandonment and replacement include: overhead and underground electric, telephone and cable lines; underground communication lines; roadway lighting, stormwater pipes and inlets; public water pipes; sewer pipes and manholes; and gas lines. (see the Rockville BRT Station Integration Map Atlas in Attachment C).

Stormwater piping and inlets would have to be relocated due to the tunnel construction and/or where roadway widening is necessary at either ends of the tunnel. Overhead telephone lines would be either replaced on relocated utility poles or buried underground. Overhead electric lines (primary voltage and feeder lines) and overhead telecom and fiber lines would be either replaced on relocated utility poles or buried underground. Due to the construction of the tunnel, sewer and water lines may need to be relocated.

The utility poles in this corridor also have standard “cobra head” street lighting arms and lamps. If the utility poles are relocated, the arms and the lamps may need to be upgraded. If the utilities are placed underground, new street lighting will be required for the corridor. Supply lines may need to be rebuilt and/or relocated to different locations of buildings necessitating internal electrical retrofits.

A total of 28,900 SF or 0.66 acres of additional impervious surface would be added and need mitigation. See Concept 4 for discussion of stormwater BMP options.

Operations

BRT operations, running in dedicated lanes, could fully support the projected passenger vehicle level of service.

Pedestrian volumes would be similar to those discussed in Concept 4, however pedestrian circulation would be more efficient and safer with the single large platform in Concept 6. This concept provides the most direct connection with the Metro station for pedestrians.

Intersection capacity analysis for vehicles was performed for Concept 6 using the Highway Capacity Manual methodology. Although the tunnel would provide a net gain of one additional travel lane in each direction, the analysis conservatively assumed, due to the surface capacity reduction of 33% (i.e., one travel lane in each direction), that a minimum of 33% of the existing through traffic would be diverted into the tunnel. More detailed forecasting of local versus through traffic demand is recommended, particularly given the fact that a longer tunnel may serve less through traffic due to the existing large turning volumes at each intersection, although the presence of the tunnel may also serve a higher volume of through trips.

The intersection capacity analysis results indicate that one intersection only, MD 355 at Middle Lane, would deteriorate; from a LOS D to a LOS E, identical to Table 2 under Concept 4. The change in LOS results from the reduction in surface travel lanes; even with the reduction of 33% in through volumes, the existing average vehicle delay value is so close to the LOS E threshold that the need to continue to serve all side street and mainline left-turn volumes results in the change.

Right of Way

Concept 6 would impact 15 individual parcels and require approximately 12,500 square feet (0.29 acres) of additional right-of-way. (Attachment I).

Cost

The project cost for Concept 6 is estimated to be approximately \$214 million, using the SHA's Major Quantities Estimates methodology. (See Attachment J for the cost estimate break down).

The cost estimate does not include right of way or utility undergrounding/relocation costs although they may be covered under percentage-based items/contingencies.

The risks and complications associated with tunnels make the development of planning-level estimates challenging. A careful review of items such as site topography, soil conditions, and subsurface structures is needed to allow an estimating engineer to determine reasonable values for construction alternatives with more confidence¹³. Such information is not available at this

¹³ For example, if the project were to move forward into design, engineers would need to investigate extensively the soil typology to determine the ability to bore a deeper tunnel. Certain depths of soil may be unsuitable for a tunnel bore. If the tunnel could not be bored due to soil type and had to be placed more shallow, the resulting cut and cover construction method could potentially be more expensive as it may require extensive construction sequencing and property mitigation due to the impact to existing traffic volumes and adjacent parcels.

planning level of project development. With this in mind, a cost range of \$200 million to \$300 million is advisable for future planning.

As noted above, station costs can vary widely depending on location (side or median) features, and amenities. Capital costs prepared for the Capital cost estimates prepared in July 2015 for the County Executive's Transit Task Force estimated the cost of a station for a two-lane median BRT with 4 travel lanes at \$3.6 million (see Attachment J).

Urban Design – Town Center integration opportunities

Concept 6 offers great opportunity for continuous public realm and urban design improvements throughout the MD 355 and MD 28 corridors within the Town Center area because this concept requires a dedicated center median with BRT lanes over a tunnel for thru traffic alignment.

Concept 6 would require modest expansion, improvement and realignment of the roadway right-of-ways allowing for wider public realm right-of-ways and streetscapes for pedestrians, as well as more room for private development/redevelopment on key parcels fronting the corridors.



MD 355 corridor 'Central' focus area at WMATA Rockville Metro Station

Reconfiguration of both corridors to serve local and BRT traffic, with MD 355 thru traffic directed to a new four-block tunnel would offer great opportunities for: enhancement of existing public realm spaces; creation of additional public park/plaza spaces; and economic redevelopment of underutilized public and private sites along the corridor on the eastern edge of the Town Center. Figure 24 illustrates a series of potential urban design improvements that could be introduced along the corridor in association with this concept. Concept urban design improvements include: (see numbers on Figure)

1. ***Improved crosswalks and pedestrian refuges*** in the medians at East Middle Lane/Park Road and Monroe Place/Church Street Intersections. Crosswalks could be uniformly expanded and newly paved or striped to increase visibility and lower conflicts between pedestrians and vehicles. The crosswalks could lead to new pedestrian refuge areas located within landscaped and tree-lined medians, offering pedestrians a safe place to rest when crossing the multi-lane boulevard.
2. ***Improved streetscape walkway environs*** along both sides of the MD 355 and MD 28 corridors that complement and extend the character of Rockville's Town Center streets. This could include a new streetscape palette of wider walkways pulled away from the roadway curbs with planted tree lawns or in-ground tree planters, complemented by pedestrian lights, occasional street furniture, and trash receptacles at crossings and waiting areas.

3. ***Continuous planted medians*** between the dedicated BRT lanes and the neighboring auto travel lanes that would help to: soften the amount of paving, beautify the new boulevard setting, provide areas for pedestrian crossing refuges and better define modes of travel along the corridors.



Figure 24 Concept plan illustrating the potential urban design improvements with BRT in dedicated median lanes with thru traffic in a tunnel below along the central portion of the MD 355/Rockville Pike corridor

4. ***Potential future private redevelopment*** of the 255 Rockville Pike site and joint public-private redevelopment of the west side of the WMATA Rockville Metro Station site. Figure 25 is a vision for what the MD 355- Rockville Station West Side could look like with the introduction of BRT and redevelopment. Figures F and G are preliminary thoughts intended to convey the economic development potential for two sites. The 255 Rockville Pike site is shown as accommodating three transit-oriented, mixed-use buildings of 9 to 11 stories surrounding a public park-plaza, with commercial/office space on the first three floors and residential apartments or condominiums on the floors above. Parking would be provided in an interior and below-grade parking structure wrapped with ground floor retail spaces that would benefit from the visibility and new pedestrian amenities provided along Rockville Pike, East Middle Lane and Monroe Street.



Figure 25 *Sketch looking south over improvements under the “Dedicated Median Lanes & Tunnel” BRT alignment*

The ‘WMATA West Side’ site is shown very conceptually with similarly-scaled transit-oriented, mixed-use development with ground floor retail, a potential hotel (which was originally envisioned on this site as a need well before the recent opening of the Cambria Suites Hotel), and market rate office/residential spaces served by both an integrated parking deck and underground parking. The Metro Bus facilities are shown as reconfigured to ‘loop’ the development block with an interior busway between Park Road and Church Street and a transfer center atrium linking with the Rockville Metro Station above¹⁴.

Figures 24 and 25, for the first time, combine concepts from the City’s Town Center Master Plan and WMATA’s 2005 Rockville Metro Station Access Improvement Study to show the potential for a cohesive BRT, transit-oriented approach to the Rockville Metro Station area.

5. ***New center island, low-profile BRT station platform with transit rider amenities*** such as all-weather transit shelters, adequate seating for waiting patrons, posted maps and schedules for orientation, and digital messaging with apps for tracking real time BRT vehicle arrivals and departures. The centerline BRT platform would be shared by both northbound and southbound BRT lines loading and unloading from the left side of the vehicle. The central

¹⁴ This approach to the site’s development is described in the WMATA’s 2005 Rockville Metro Station Access Improvement Study.

BRT platform and shelter would be linked to a new sculptural, gateway pedestrian bridge and the Metro Station via a combination of all-weather stairs, escalators or elevators landing in the BRT platform.

6. ***Potential future extension of the Metro Station platform*** over Park Road to provide more direct secondary access between the northern portion of Rockville Town Center and the Rockville Metro Station. This element was in WMATA's 2005 Rockville Station Access Improvement Study.
7. ***Realignment of the WMATA parking lot and drop-off/pick-up area improvements*** north of Park Road to accommodate a slight widening and realignment of the MD 355 corridor to the east to accommodate two BRT lanes, medians and platforms in place of two roadway travel lanes.
8. ***Potential new gateway bridge/promenade*** linking the Rockville Metro Station platform with future redevelopment and public plaza spaces on the WMATA west lots and the 255 Rockville Pike site. The new BRT travel lanes, medians and platform alignments, as well as the overall width of right-of-way required for the dedicated BRT lanes with tunnel below option, would require the existing pedestrian bridge to be replaced with a more modern equivalent that could also be a gateway statement into Rockville Town Center. A new pedestrian promenade is a central feature of the Town Center Master Plan and is recommended as a "catalyst project."
9. ***New covered stair/escalator and elevator access to the new elevated park plaza*** at the end of the Montgomery Avenue retail area on the east side of Monroe Street would facilitate improved pedestrian access between the Town Center, the 255 Rockville Pike site redevelopment, the WMATA west side site redevelopment and the Rockville Metro Station.

Figure 25 coupled with the images from other successful BRT systems in the U.S. and abroad (see Figures 26 to 29) show both the potential vision for what the BRT system could be for Rockville as well as the quality standards to ensure that the BRT will be a positive extension to the Rockville Town Center. Figure 30 is another sketch of the vision concept, this one looking northwest over the BRT.



Figure 26 Sample centerline transit platform and shelter for “Dedicated Median Lanes with Tunnel” BRT alignment



Greener solutions to busway surface and places for public art in the median



High quality BRT station architecture and platform environments



Central median stations and platforms with special paving



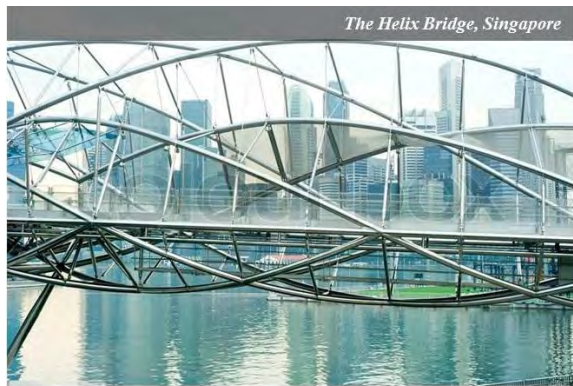
Central median stations and platforms

Figure 27 Sample urban design improvements for “Dedicated Median Lanes with Tunnel” BRT alignment



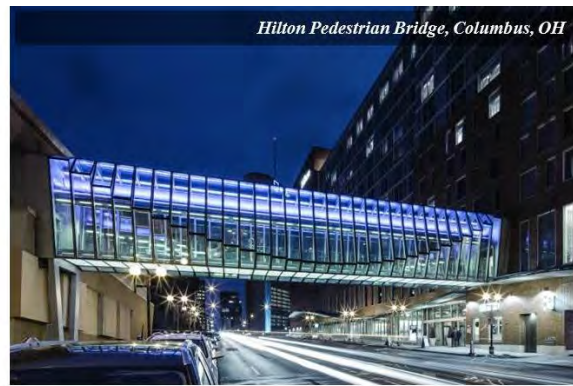
Figure 28 Sample crossing, pedestrian refuge and median for “Dedicated Median Lanes with Tunnel” BRT alignment





The Helix Bridge, Singapore

Signature bridge crossing from Metro Station to Town Center



Hilton Pedestrian Bridge, Columbus, OH

High quality BRT station architecture and platform environments



Paleisburg Pedestrian - Cycle Bridge, Netherlands

tairs, escalator and elevator transition to MD 355 crossing & Metro Station



Paleisburg Pedestrian - Cycle Bridge, Netherlands

Living bridge and promenade environment over MD 355

Figure 29 Sample gateway pedestrian bridges, promenades and escalator/stair access for consideration under the “Dedicated Median Lanes with Tunnel” BRT alignment



Figure 30 Sketch looking northwest over improvements for the “Dedicated Median Lanes & Tunnel” BRT approach

The MD 355–Rockville Pike ‘North’ Focus Area

The northern segment of the study area between Beall Avenue and North Washington Street could benefit greatly from BRT line and the urban design improvements its implementation could bring. Illustrated in the photo to the right, the character of the corridor currently changes dramatically behind the MD 355 right-of-ways north of Beall Avenue, where buildings are significantly set back to accommodate convenient ‘front door’ surface parking and servicing. Concept 6 has the potential to transform this corridor segment to a beautiful, new transit-oriented boulevard with paralleling walkable address (service) streets providing access to buildings, parallel/angled on-street parking and parking lots, as well as an improved pedestrian environment along MD 355 and the service streets between parcels. Figure 31 illustrates a series of potential urban design improvements in association with Concept 6.



North end of the MD 355–Rockville Pike corridor between Beall Avenue (right) and Washington Street (left)

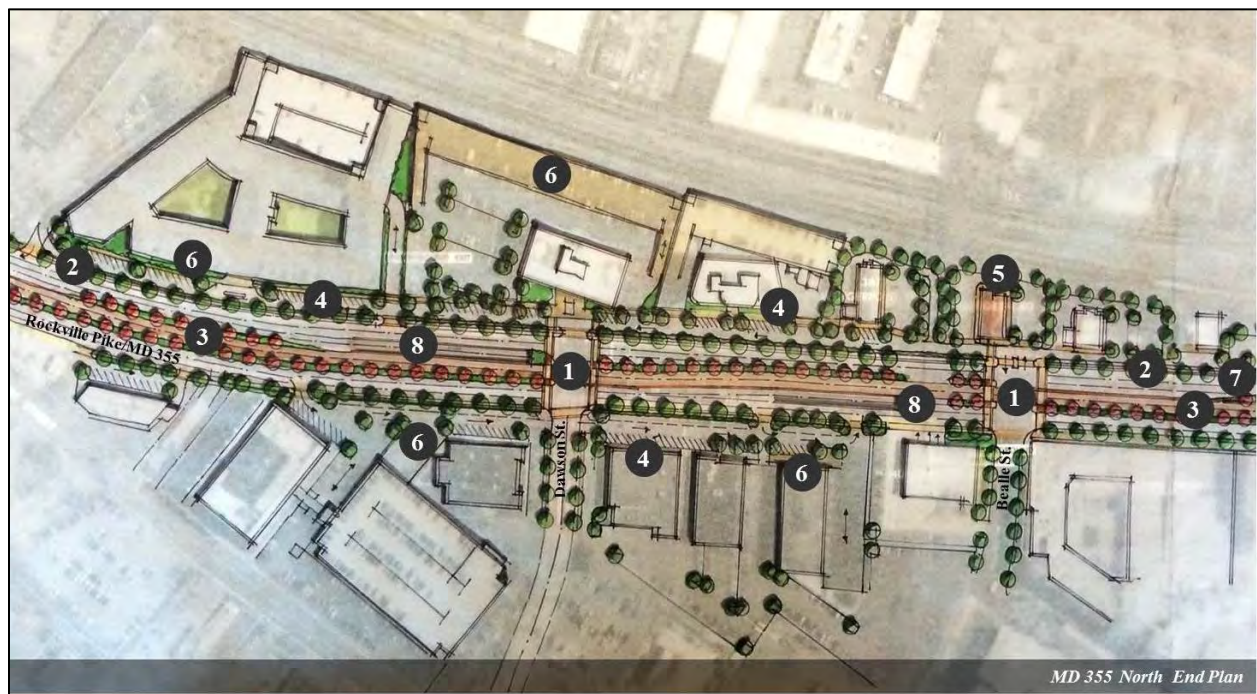


Figure 31 Design concept for northern segment of the study area

Improvements could include:

1. **Improved crosswalks and pedestrian refuges** in the medians at the Beall Avenue, North Washington Street and future Dawson Avenue intersections with MD 355. Like the Central area, crosswalks in the north end could be uniformly expanded and newly paved or striped to increase visibility and lower conflicts between pedestrians and vehicles. The crosswalks

could lead to new pedestrian refuge areas located within landscaped and tree-lined medians, offering pedestrians a safe place to rest when crossing the multi-lane boulevard.

2. ***Improved streetscape walkway environs*** along both sides of the MD 355 corridor that complement and extend the character of Rockville's Town Center interior streets. This could include a new streetscape palette as described above.
3. ***Continuous planted medians*** between the dedicated BRT lanes and the neighboring auto travel lanes, as described above.
4. ***Potential areas for parallel service street segments*** between Beall Avenue and North Washington Street. The surface parking areas for the residents and businesses on either side of MD 355 would likely be encroached upon by right-of way needs for both Concepts 4 and 6, though less in Concept 6. This is both an issue and an opportunity, as it offers the chance to re-envision the cross-section of the corridor between building facades and consider the option of creating an urban boulevard with parallel address streets such as on 16th Street N.W. in Washington D.C. or on North Charles Street in Baltimore. Figure 32 shows similar address/service street concepts that could be applied. This would maintain access to all of the existing uses as well as their off-street parking, with the addition of new parallel or angled parking on the service streets.



Figure 32 Sample urban design improvements for the “dedicated median lanes with tunnel” BRT alignment – North MD 355/Rockville Pike

5. ***Potential sites for infill redevelopment*** on parcels whereby the right-of-way widening to accommodate the BRT line may impact existing business buildings and sites to a point where it makes economic sense to reconfigure/redevelop the site for the same tenant, or a new use that can better benefit from the proximity of the BRT and the new parallel service street access described above.

To convey this concept the current Merchants Tire and Auto Center site has been illustrated as a possible small-scale redevelopment site due to the building's relatively close location to the right of way. Much larger individual or consolidated frontage sites on the west side of MD 355 north could also undergo future redevelopment in concert with the BRT line as illustrated in the Town Center Master Plan or as new buildings fronting MD 355 like the Choice Hotels headquarters block immediately to the south. One such site could be the Rockville Volunteer Fire Department site, where apparently the fire officials are in need of additional space in the Town Center area beyond what their existing site will accommodate.

6. ***Potential alternate parking solutions*** for residential and commercial buildings where right-of-way widening to accommodate BRT may impact the existing surface parking along the corridor frontage. The intent would be to plan for the future addition of parking decks over a portion of existing neighboring parking lots and designate them for shared use public parking or reserved space parking.
7. ***Fewer travel lanes*** in the area between north and south end tunnel entrances and exits. As discussed earlier, MD 355 would be reduced from six lanes to four local lanes on the surface, with four new travel lanes provided below grade to accommodate current and future growth in through traffic in Rockville. The reduction in travel lanes would provide much of the area needed for the BRT lanes, station platforms and landscaped medians while also making the corridor safer for pedestrians, providing a greater sense as a local street given the removal of a significant amount of through traffic.
8. ***Diversion of MD 355 through traffic into a tunnel*** extending from the staggered entries and exits at the Dawson Avenue and Beall Avenue area in the north end to similar staggered entries and exits at the Dodge Street and Mt. Vernon Place area at the south end of the Town Center.

With these associated improvements, the addition of BRT to the north end of MD 355 has the potential to help redefine the north gateway into the Rockville Town Center and expand the already successful Town Center image to the Metro railway tracks to the east.

The MD 355–Rockville Pike & Veirs Mill Road ‘South’ Focus Area

The southern segment of the study area, between Monroe Place and Mt. Vernon Place, is more complicated than the North and Central areas due to a second BRT line entering from the southeast on the high traffic MD 28-Veirs Mill Road/East Jefferson Street corridor. This area also presents more opportunities for positive change creatively resolving ongoing traffic and pedestrian issues that affect the area.



The concepts in this section (South focus area) were prepared to show potential solutions for the MD 355/Veirs Mill Road intersection within the context of Concept 6. The concepts have an urban design focus, and did not undergo engineering proof of concept. Since these corridors carry high traffic volumes, are state controlled, and that they surround the Veterans Memorial Park, the concepts will need to be studied in more detail and thoroughly vetted with City of Rockville, Montgomery County and the Maryland State Highway Administration, to decide the best combination of motor vehicle, transit and urban design solutions.

Like the North area, the introduction of BRT and a tunnel to this area has the potential to change its image from a highly congested ‘mixing bowl’ partly surrounded by suburban style commercial development to a refined south Rockville gateway entry reinforced by a mix of urban infill development that would benefit from an enhanced park address as an extension of the Rockville Town Center environment. Figure 33, illustrates a series of potential urban design improvements that could be introduced along the corridor in association with Concept 6. Improvements could include:

1. ***Improved crosswalks and pedestrian refuges*** in the medians at the Veirs Mill Road/East Jefferson Street, Dodge Street and Mount Vernon Place intersections with MD 355. Like the Central and North areas, the crosswalks in the south end could be uniformly expanded and newly paved or striped to increase visibility and reduce conflicts between pedestrians and vehicles. The crosswalks could lead to new pedestrian refuge areas located within landscaped and tree-lined medians as well as the Veterans Memorial Park, offering pedestrians a safe place to rest when crossing the multi-lane boulevards on MD 355 and MD 28.
2. ***Improved streetscape walkway environs*** along both sides of the MD 355 and MD 28 corridors that complement and extend the quality and character of Rockville’s Town Center interior streets. This would include an extension of the new streetscape elements described above.



Figure 33 Concept illustrating the potential urban design improvements with BRT in dedicated median lanes with thru traffic entering/exiting a tunnel at the southern portion of the MD 355/Rockville Pike corridor

3. **Continuous planted medians** between the dedicated BRT lanes and the neighboring auto travel lanes would be continued into the South area along both the MD 355 and MD 28 corridors to reduce the amount of paving, beautify the newly improved boulevard and park settings, provide areas for improved pedestrian crossing refuges and new refuges where none exist.
4. **Veteran's Park edge enhancements** along the MD 355 and MD 28 corridors including the extension of the new streetscape palette around the perimeter of the park.
5. **A road diet for East Jefferson Street** between MD 355 and Fleet Street that would focus on removing and replacing the two highway-scaled ramps on the north and south sides of East Jefferson Street with urban-scaled right turn and merge lanes that would reduce the overall scale of the intersection and its north-south pedestrian crossings. The open space gained as a result of the reconfiguration could be used for public open space to the south and potential parking lot mitigation (discussed below) to the north.
6. **Potential alternate parking and servicing solutions** for the Americana Plaza residential buildings on the west side of MD 355. The MD 355 west side right-of-way and Americana Plaza carport parking are currently juxtaposed in a manner that constrains the pedestrian environment to an uncomfortable dimension. Removal and realignment of the East Jefferson turn lane ramps would free-up additional space on both the southwest and northwest corners

of the MD 355-MD 28 intersection that could be considered for both BRT corridor stormwater management mitigation as well as redefined parking for Americana Plaza. Figure 33 shows a reconfiguration of the Americana Plaza parking that could maintain the current number of parking spaces, while also providing additional perimeter buffer space to screen the parking and provide wider walkways set back from the street with a tree lawn and shade trees creating a better pedestrian experience.

7. **Fewer travel lanes** in the area between north and south end tunnel entrances and exits. MD 355 would continue to be reduced from six-lanes to four local lanes on the surface, with four new travel lanes provided below grade to accommodate current and future growth in through traffic in Rockville. The reduction in travel lanes will provide much of the area needed for the BRT lanes, station platforms and landscaped medians while also making the corridor safer for pedestrians.
8. ***Diversion of MD 355 thru traffic into tunnel*** extending from the staggered entries and exits at the Dodge Street and Mt. Vernon Place area in the south end to similar staggered entries and exits at the Dawson Avenue and Beall Avenue area at the north end of the Town Center.

The design elements in Figure 33 would help improve this existing south gateway to the Rockville Town Center. However, an initiative as significant as introducing BRT and a tunnel to the MD 355 corridor also lead to bigger ideas for resolving the traffic congestion in the ‘mixing bowl’ area by Veterans Memorial Park¹⁵. The relocation of MD 355 traffic below-grade with BRT and improved local traffic at the surface provides the opportunity of rethinking the roadway network associated with MD 355, MD 28, East Jefferson Street, Dodge Street and other nearby local connecting streets.

Thinking beyond the potential solution presented in Figure 33, there may be an opportunity to reconfigure these same streets into a one-way elongated round-about (see Figure 34), which is similar to an existing one in the Towson Town Center, or a larger one-way street circulator system (see Figure 35) that could accommodate all existing turning movements and access points, while also creating a setting for new dedicated BRT routes and an expanded civic gateway space for Rockville. The reduced volumes on the MD 355 “local lanes” may be enough to re-engineer this intersection so it serves multiple modes more effectively (vehicles, transit, pedestrians and bicyclists). Circulation impacts on Richard Montgomery High School would need to be part of any future analysis of these design concepts.

The gateway round-about and parks concepts could take many forms, as illustrated in the sample illustrations from Sergio Cardell Plaza in Alicante, Spain (see Figure 36) or a gateway park in Chicago, Illinois (see Figure 37). Either would be a dramatic departure from the current configuration of the MD 355 - MD 28 ‘mixing bowl’ and allow this area of Rockville to reach its full potential from transportation, economic development, gateway and public open space perspectives.

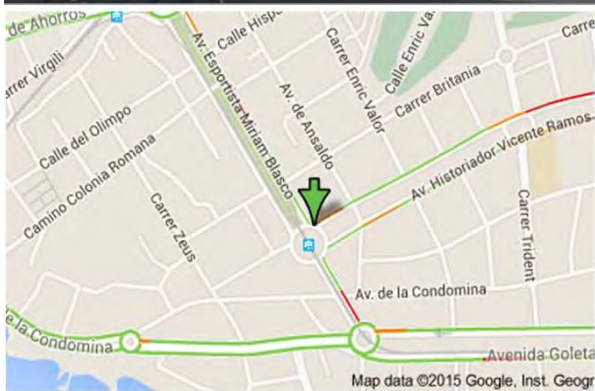
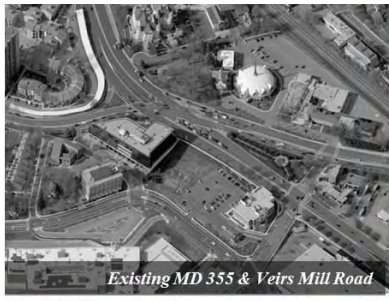
¹⁵ These ideas were presented at the Interagency Staff Workshop, August 27, 2015, see Attachment F.



Figure 34 Concept sketch illustrating the potential for an elongated, gateway round-about and expanded visual park feature at the Rockville Pike/Veirs Mill Road intersection.



Figure 35 Concept sketch illustrating the potential for a one-way circulator road and expanded gateway park and transit plaza at the Rockville Pike/Veirs Mill Road intersection.



Transit crossing within round-a-bout at the intersection of two boulevards



Transit stop within civic gateway stop with unique station identity as art



Figure 36 Sample round-a-bout incorporating transit within for consideration under the “Dedicated Median Lanes with Tunnel” BRT concept



Figure 37 Sample urban design improvement opportunities for “dedicated median lanes with tunnel” BRT alignment

6. Comparison of Concepts, Conclusions

Table 3 summarizes the Key Design and Operational Considerations for each of the three concepts.

The three BRT concepts examined in this Study offer varying levels of BRT and transportation improvements, although in some measure they provide similar types of urban design improvement opportunities. However, they do vary in terms of scale and ability to create dramatic and positive change on the MD 355-Veirs Mill Road corridors and integrate with Rockville's Town Center. From an urban design perspective, and with all other aspects of the alternatives, including cost, set aside:

- Concept 2, with the mixed-traffic BRT and near side pull-outs, offers a good early-phase approach to getting BRT established relatively quickly on the corridor with stations and platforms that directly engage the pedestrian environment. The scale of the initial improvements would establish an initial prototype public realm setting that could be expanded along the full length of the corridor by the City of Rockville working in partnership with Montgomery County and the State of Maryland as other future stops are added or redevelopment occurs along the corridor, sparking added public and private realm improvements.
- Concept 4, with the BRT dedicated lanes in median at-grade while maintaining all existing travel lanes, offers a very efficient BRT system at the cost of a very wide, expanded right-of-way and cross section. This would adversely impact WMATA operations, private properties, parking, access, traffic congestion, pedestrian crossing lengths, with additional possible conflicts between pedestrians and vehicles turning at key intersections such as Park Road and Middle Lane with MD 355. Similar public realm, urban design improvements to Concepts 2 and 6 could be made under this concept, but would require added right of way that may not be available in constrained areas or would encroach on and impact the current and/or future use of parcels along the corridor. The public realm enhancements in this scenario would likely be more at risk of being reduced in scope and thus less effective in conveying a positive image for Rockville and the Town Center.
- Concept 6, with the BRT dedicated lanes in median with through traffic in a tunnel, offers all the advantages of a very efficient, expandable BRT system within only a slightly larger public-right-of-way in some areas. The BRT station would be in very close proximity to the Metro station, providing ease of access for transfers. The expanded right-of-way that might be needed could be accommodated and mitigated, while maintaining or reconfiguring all existing parking and access along the Town Center portion of the MD 355 corridor. This concept would provide an excellent opportunity for establishing a consistent and unified public realm environment from Mt. Vernon Place to North Washington Street. It would also have the added potential of relieving traffic pressure on the mixing bowl allowing it to also be reconfigured into a significant public open space/development area connecting Rockville Pike with Town Center. The overall corridor effect would be a more "calm" local and complete street, but in a corridor where the overall capacity (and presumably safety as well) would have been enhanced for transit users, automobiles, pedestrians and bicyclists.

Table 3 Summary of Key Design and Operational Considerations

	Concept 2 - Mixed-traffic with near side pull-outs		Concept 4 - Dedicated lanes in median		Concept 6 - Dedicated lanes in median with through traffic in tunnel.	
	Benefits	Drawbacks	Benefits	Drawbacks	Benefits	Drawbacks
Operations	<ul style="list-style-type: none"> • New transit option • Minimal impact to vehicle traffic • BRT station is curbside, close to Metro • No change to existing vehicle lane widths 	<ul style="list-style-type: none"> • May not provide reliable transit travel times • Needs signal phasing modification for BRT priority 	<ul style="list-style-type: none"> • New transit option • Dedicated bus lanes provide more reliable BRT travel times • Modest impact to traffic operations, and only in 2 locations where left-turn lanes are impacted 	<ul style="list-style-type: none"> • Reversible lane segments may cause bus delay • BRT station is in median (pedestrian connection to Metro at grade) • Needs signal phasing modification to accommodate high pedestrian volumes at station; additional potential conflicts between vehicles and pedestrians is possible at 355 and Park/Middle especially with turning movements • Narrower than existing vehicle lane widths • Potential for platform crowding and ADA access issues 	<ul style="list-style-type: none"> • New transit option • Dedicated bus lanes provide more reliable BRT travel times • Significant through vehicle traffic eliminated from surface of MD 355 • Maintains or improves current level of service at all but one intersection (at least a 33% reduction in existing PM through traffic volume) • Potential to retain existing vehicle lane widths • BRT station is in median (pedestrian connection to Metro at or above grade) 	<ul style="list-style-type: none"> • Potential weaving of local and through traffic at tunnel entrance and exits • Reduces at grade capacity of MD 355 (taking lanes for BRT)

	Concept 2 - Mixed-traffic with near side pull-outs		Concept 4 - Dedicated lanes in median		Concept 6 - Dedicated lanes in median with through traffic in tunnel.	
	Benefits	Drawbacks	Benefits	Drawbacks	Benefits	Drawbacks
Urban Design	<ul style="list-style-type: none"> • Lowest cost and easiest to implement of the 3 concepts; allowing for greater investment in design amenities • Needs less land acquisition and agreements • Simpler construction and shorter time to build • Provides for improved pedestrian crossing refuges at 355 and Park/Middle 	<ul style="list-style-type: none"> • Needs wider right-of-way and cross-section than exists today at BRT station locations and transition areas • Lengthens the crossing distance for pedestrians • Some encroachment on the WMATA land requiring realignment of parking, Kiss' n' Ride and bus routing 	<ul style="list-style-type: none"> • Simpler construction and shorter time to build than the Tunnel Option • Provides for new pedestrian crossing refuges • Lower cost than the Tunnel Option 	<ul style="list-style-type: none"> • Needs wider right-of-way and cross-section than exists today • Needs more land acquisition and agreements than the Mixed-Traffic and Tunnel Options • Longer crossing distances for pedestrians than the Mixed-Traffic and Tunnel Options • Potential encroachment on the Veterans Park 	<ul style="list-style-type: none"> • Narrower right-of-way width and cross-section required thus less property acquisition needs than concept 4 • Allows for more open space and amenities on surface; opportunity for stronger place-making, redevelopment opportunities, and other potential circulation improvements • Maintains similar crossing distances to today. Provides for pedestrian crossing refuges 	<ul style="list-style-type: none"> • Highest cost of construction of the three options • Highest construction complexity and longer time to build

Conclusion

Based on the analyses and assessments in this Study, of the three Bus Rapid Transit Concepts, Concept 6 (dedicated lanes in median with through traffic in tunnel) would offer the greatest opportunities for transportation and urban design improvement in the central portion of the MD 355 – Rockville Pike corridor because it would remove two at-grade travel lanes and replace them underground with four through traffic lanes. This positive transportation trade-off would also allow the existing right-of-way to be better utilized for pedestrian and BRT transit patron use at the surface, enhancing the corridor for multi-modal use. It requires relatively modest widening in some areas of the central area, while also optimizing the number of both public realm spaces for enhancement and public/private properties for economic redevelopment along the corridor. Concept 2 (mixed traffic with pullouts and queue jumps) offers a viable cost effective, short term solution in the interim, if necessary.

Attachments

The attachments contain much of the background and meeting materials used to develop this Integration Study. The volume of material is large and is provided in electronic format only. All materials are available on the City's website within the Department of Community Planning and Development Services pages under Bus Rapid Transit within the Long Range Planning section (<http://www.rockvillemd.gov/BRT>).

Some of the electronic files are several megabytes and may take some time to download.

Attachment A	Document Chronology
Attachment B	Study team kick off meeting, January 8, 2015
Attachment C	Interagency Coordination Meeting, March 4, 2015
Attachment D	Study team meetings, March 26, 2015, May 4, 2015
Attachment E	Interagency Workshop, May 21, 2015
Attachment F	Interagency Staff Workshop, August 27, 2015
Attachment G	Presentation to Mayor and Council, September 28, 2015
Attachment H	Engineering Drawings Concepts
Attachment I	Right of Way and Impervious Surface Calculations
Attachment J	Cost estimate